SCIENTIFIC AMERICAN SUPPLEMENT. No. 1238

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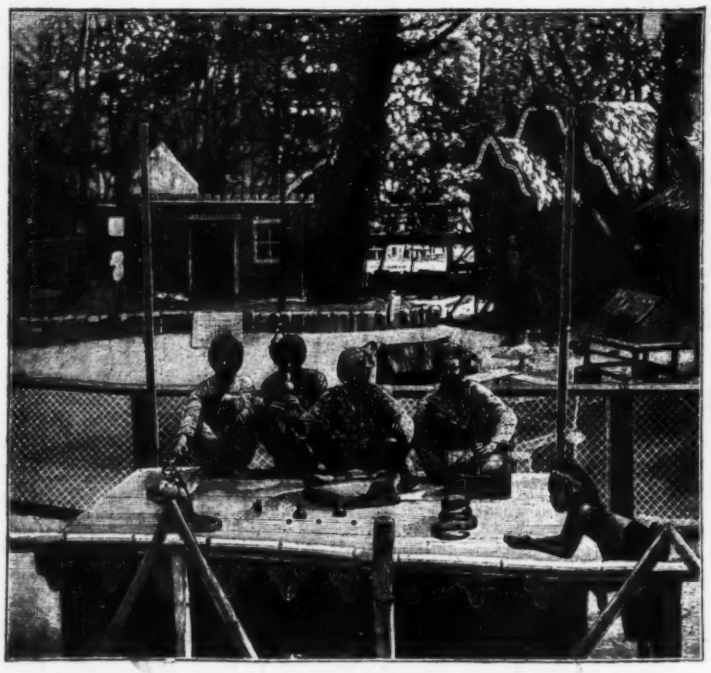
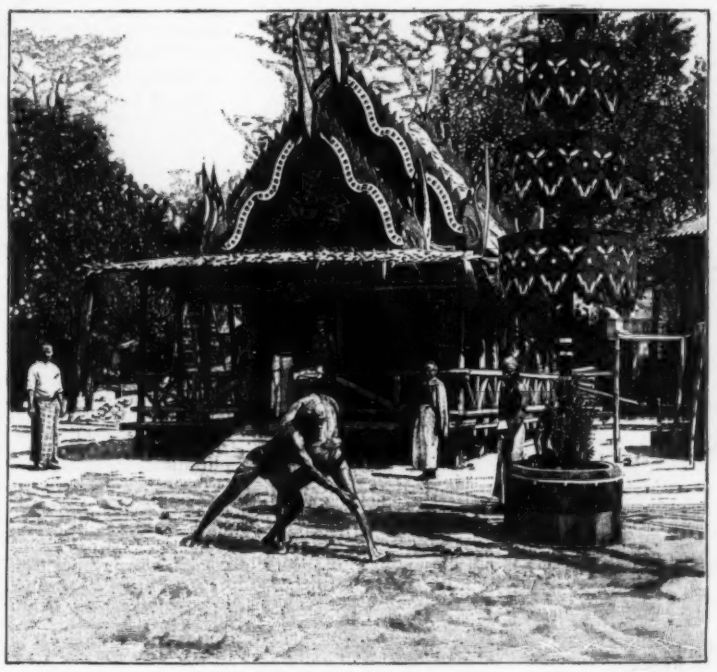
Scientific American, established 1845.
Scientific American Supplement, Vol. XLVIII. No. 1238 } NEW YORK, SEPTEMBER 23, 1899. { Scientific American Supplement. $5 a year.
Scientific American and Supplement. $7 a year.



HINDOO JUGGLERS.



SIKHS WRESTLING.

GROUP OF NATIVES OF SIAM, MADRAS, AND THE PUNJAUB.

THE EAST INDIA VILLAGE IN THE VIENNA ZOOLOGICAL GARDEN.

THE EAST INDIA VILLAGE IN THE VIENNA ZOOLOGICAL GARDEN.

THE managers of the Zoological Garden in Vienna, who are constantly striving to present some interesting ethnographical novelty to the public, have this year imported about eighty people from Siam and the neighboring countries to constitute a village, and those who visited the garden this spring had the pleasure of seeing them put the finishing touches on the many-colored little structures scattered among the shrubbery which serve as their shelter for the summer. The men and women may now be seen sitting at the doors of these huts or on the hearths of the primitive kitchens, or they will be found wandering majestically or idly among the visitors, in white or colored burnouses, each according to his caste, while the children play noisily in canoes on the pond, sometimes running into a small Buddha temple standing in the water. Symbols of all kinds, mostly of a religious nature, are secured to the gables of the huts, before which the cabinet maker, the goldsmith, weaver, tailor and sculptor are busy at their trades.

The people in the village are not all Siamese. It is a well-known fact that the Siamese, on account of a vassalage which has lasted for hundreds of years, have become indolent and utterly lacking in energy, and the men as well as the women, although well proportioned, are small; their flat olive faces and the form of their skulls indicate neither the pure Mongolian nor the pure Malay type. They are good natured and patient, always playing a passive role. In one of our engravings we see some of them standing as spectators while two young men of the Sikhs race are wrestling.

These Sikhs, who are tall, powerful men with fiery eyes, are worthy of special attention. They belong to a peculiar religious sect and have played an important part in the history of India. In times of peace they cultivate the ground diligently, but in the Anglo-Indian army they make brave soldiers. They fought like heroes for their religion and their independence until 1849, when they were defeated and were incorporated in the British-Indian Empire; it seems strange that these men of Maccabean nature should become the hirelings of the Siamese. In the foreground of another of our engravings, in a group of East Indians from Siam, Madras and the Punjaub, we see the gigantic figure of an old Sikh, who does good service in the village in the Zoological Garden as a sort of policeman. Several Hindoos also joined the troop who entertain the public, and apparently themselves, with musical productions, snake charming and the well-known fakir tricks.

The most numerous group in the village is composed of Telingas, who, like the Tamils, belong to the Dravida race. These represent the real working class in their native Farther India and in the Malay Archipelago. Most of the efficient workers in this village are Telingas; they made the picturesque structures out of bamboo and palm leaves. Among them there is a barber who shaves the foreparts of his compatriots' heads, but seldom shaves their thin beards; and they also boast of a tattooer who is always busy, for these people consider that certain characters tattooed in the skin are not only very decorative but also a protection from evil spirits. There are some "sensitives," who content themselves with having the figures simply painted on their brown skin.

The women are unattractive without being absolutely ugly; those of the Telinga and Dravida races are markedly different from the women of the other tribes. In these tribes the woman is not a slave, but an equal of the man. It is interesting to see how gallantly they are served by the men when they are cooking. They frequently wear rings in their nostrils such as European women wear in their ears. Here we may see how men ate before the invention of spoons and forks.

In the village there is a school for the children, who trace the characters of the Sanskrit alphabet on the sand that is spread over the floor, by means of little sticks.

Before and after the exhibitions given by the "artists" of the troop, the people walk about in single file, according to the Siamese fashion. There, when a family goes abroad, the father marches first; he is followed by the mother, and then come the children in order according to their size.

Among these men is one who speaks English and claims to be a friend of Prof. Häckel's, whom he served as guide during a journey through India.—Ueber Land und Meer.

SPIDERS' MUSICAL ORGANS.

AT the meeting of the British Association, Mr. R. J. Pocock read a paper on the subject of "Musical Organs in Spiders." He pointed out that the sound organs of spiders were in many cases constructed on exactly the same principles as a musical box; and after describing, with the aid of diagrams, the position of the sound organs and the means by which the sounds were produced, he went on to consider the use of these organs. The activities of any animal, he said, were directed toward one of four purposes—the procuring of food, the avoidance of enemies, the reproduction of the kind, or the protection of the young. The sounding organs of the spider fell into two categories. There were the cases in which the organs were equally well developed in both sexes, and appeared early in the life of the individual, and there were the cases in which the organs appeared only in the male, or were much more fully developed. The significance of the organs in the latter case was purely sexual, and the sounds might serve to assure the female of the identity of the male, for owing to the strength and voracity of the female, the period of courtship was full of risks for the male. As to the case where the organs were equally developed in both sexes, there was no reason to suppose that they had any sexual significance whatever. Their use was to warn approaching enemies, for when these spiders were attacked, it was their habit to rear up and stridulate. These large spiders were poisonous and inedible, and the stridulation was to prevent their being destroyed by enemies in ignorance of their distasteful qualities. The power to stridulate in these cases served the same purpose as the bright coloring which distinguished poisonous reptiles and insects. Where the sounding organs were equally developed in both sexes, there was no reason to believe that the spiders themselves heard the sounds which they produced.

ARTIFICIAL MINERAL WATERS.

By THOMAS WARWICK.

MINERAL waters, both natural and artificial, have been used from time out of mind. We have it on good authority that the old Romans made artificial mineral waters in imitation of the natural springs of Sicily, Gaul, and Iberia, while, during the middle ages, the alchemists made an endless number of such imitations. In fact, the origin of soda water is due to these attempts at reproducing the natural mineral waters, and the generic name of "seltzer" water, which is the common term employed to-day among the Latin races to designate "plain soda," and is not uncommon even in England and America, owed its adoption to the fact that one of the most popular of these artificial mineral waters was the imitation of the natural water obtained from the springs of Selters, near Frankfort. The virtues of these waters were soon found to be due mainly to the carbonic acid gas they contained, and the other ingredients were gradually dropped in the imitations; bicarbonate of soda was the last ingredient to be retained, and consequently the name "soda water" has persisted to the present time.

The sale of mineral waters by druggists is much larger than would be commonly believed, and as the profit on this class of goods is much greater than that on the sweetened drinks, it pays to push their sale, and as they are more refreshing in the long run than a siruped drink, it should not be a difficult matter largely to increase the custom for these goods.

ARTIFICIAL AND NATURAL WATERS CONTRASTED.

True, I have heard it urged that any mineral water, if drunk in excess is likely to produce bad effects on the system, and this is undoubtedly the case with certain of the mineral waters, but I doubt very much if either plain soda or Vichy could ever be really harmful in the doses in which they are served up at the soda fountain. Even at the Saratoga Springs, where a customer is allowed for five cents all the mineral water he wishes to drink, I was unable to learn of any case of evil effects arising from the practice; and although I have personally known several soda water "topers," I never knew of one who suffered from his overindulgence, while I did know a number who experienced very beneficial results from the use of this beverage. The above remarks apply as well to the artificial waters as to the natural ones, for in spite of the assertions of the mineral spring owners to the contrary, the natural and the artificial waters are practically the same in their effects on the system. If anything, the artificial waters are more uniform in quality, and less likely to contain traces of injurious matters. Where the mineral spring obtains its great advantage is in the change of scene a trip thither necessitates and in the régime which has to be followed. When the choice is between a natural mineral water in bottles and a careful imitation of the same, the imitation is generally better than the natural water.

HOW ARTIFICIAL WATERS MUST BE MADE.

In making an artificial mineral water it must be remembered that it is seldom possible to reproduce the water by merely combining its chemical components. In other words, the analysis of the water cannot serve as a basis from which to prepare it, because even though all of the components were put together many would be found insoluble, and others would form new chemical combinations, so that the result would differ widely from the mineral water imitated.

For example, carbonate of magnesia and carbonate of lime, which are important ingredients in most mineral waters, will not make a clear solution unless freshly precipitated, hence when these are to be reproduced in a mineral water it is customary to employ other substances which will dissolve at once, and which will, upon combining, produce these salts. The order in which the salts are added is also a very important matter, for by dissolving the salts separately and then carefully combining them, solutions may be effected which would be impossible were all the salts added together to the water in the portable fountain.

In this connection the following table given by Mr. C. H. Sulz in his excellent work on beverages will be found very useful:

GROUP 1.

Ammonium carbonate.	Sodium chloride.
Ammonium chloride.	Sodium fluoride.
Sodium borate (borax).	Sodium iodide.
Potassium carbonate.	Sodium nitrate.
Potassium chloride.	Sodium phosphate.
Potassium nitrate.	Sodium pyrophosphate.
Potassium sulphate.	Sodium silicate.
Sodium bromide.	Sodium sulphate.
Sodium carbonate.	

GROUP 2.

Lithium carbonate.

GROUP 3.

Aluminum chloride.	Magnesium chloride.
Barium chloride.	Magnesium nitrate.
Calcium bromide.	Strontium chloride.
Calcium chloride.	Lithium chloride.
Calcium nitrate.	

GROUP 4.

Magnesium sulphate.	Alum (potassa or soda alum).

GROUP 5.

Lime carbonate.	Lime sulphate precip.
Magnesium carbonate hydr.	

GROUP 6.

Lithium carbonate.	Iron pyrophosphate.
Acid hydrochloric.	Iron sulphate.
Acid sulphuric.	Manganese chloride.
Iron chloride.	Manganese sulphate.

GROUP 7.

Sodium arseniate, or sodium sulphide, or acid hydrosulphuric.

EXPLANATION OF GROUPS.

The explanation of the use of these groups is simple. When about to prepare an artificial mineral water, the druggist should first ascertain from his formula which of the ingredients belong to group 1. These should be dissolved in water, and then be filtered and added to the distilled water in the fountain, and thoroughly agitated. Next the substance or substances belonging to group 2 should be dissolved in water, then be filtered and added to the fountain, which should again be agitated. And so the operation should proceed; whatever ingredients are required from each group should be taken in turn, a solution made, and this solution, after being filtered, should be separately added to the fountain, and the latter be well agitated before the following solution is added.

For groups 1, 3, and 4 the salts should be dissolved in five times their weight of boiling, or ten times their weight of cold, water. For group 2 (lithium carbonate), the proportions should be 1 part of lithium carbonate to about 130 parts of cold or boiling water. The substances mentioned in group 5 are added to the portable fountain in their solid state, and dissolve best when freshly precipitated. As carbonic acid gas aids their solution, it is best to charge the fountain after they are added, and agitate thoroughly, blowing off the charge afterward if necessary.

In group 5 the lithium carbonate is dissolved in the acids (see also group 2), the iron and manganese salts are dissolved in 5 parts of boiling or 10 parts of cold water, the solution quickly filtered, the acids added to it, and the whole mixture added to the fountain already charged with gas, the cap being quickly taken off, and the solution poured in. The iron and manganese salts easily oxidize and produce turbidity, therefore the atmospheric air should be carefully blown off under high pressure several times while charging the fountains. The substances mentioned in group 7 are never put into the fountain, except sometimes the arseniate of sodium in the case of Vichy water, which contains but a trifling amount of this compound.

Most of the solutions may be prepared beforehand and be used when required, thus saving considerable time.

Formulas for various waters will be given at the end of this article.

THE QUESTION OF PRICE.

Although manufacturers of mineral water salts and solutions are wont to charge fancy prices for their mixtures, so that many druggists swear they will always make their own salts, yet the sale of mineral waters is in most cases scarcely of sufficient importance to offset the economy effected by making the salts one's self. It is true that a package of mineral water salts which retails for one dollar will perhaps cost only five or ten cents when prepared in the pharmacy, but it is probable that more than a dollar's worth of time will be expended in preparing them.

A question which arises in preparing mineral waters is: "What is the best pressure at which to charge them?" As a general rule, they are charged to a lower pressure than plain soda, and I have even known good authorities to recommend charging certain mineral waters as low as 30 pounds pressure to the square inch, but this seems to me much too low a pressure for the dispensing counter. From 50 to 120 pounds pressure would be a good limit, while plain soda may be served out as high as 180 pounds. There must be enough pressure completely to empty the fountain, while enabling sufficient gas to be retained by the water to give it a thorough pungency. Moreover, a high pressure to the mineral water enables a druggist at a pinch (and I have known of several such cases), when he runs out of plain soda, to use his Vichy water, instead, with the siruped drinks. The taste of the Vichy is not very perceptible when covered by the sirup, and most customers will not notice it.

THE DISPENSING OF MINERAL WATERS.

Mineral waters should not be cooled as much as soda water, and I knew the case of one druggist who had so many complaints that his mineral waters were too cold that he went to the expense of inserting a special pipe in his apparatus, so as to be able to draw his plain soda either cool or cold at will, one pipe from the fountain passing through his regular cooler, and the other passing straight through the ice box, so that the water would not remain long in contact with the ice. As most mineral waters are drawn from portable fountains, a smaller cooler than that used for the soda water is generally employed, so that these drinks need not be served up either too hot or too cold.

Special tumblers should always be used for mineral waters. A man cannot drink as much mineral water as he can sweetened soda water, and even if he could, he would prefer to be helped twice in a small, thin tumbler, rather than once in a large, coarse tumbler. Even at the mineral springs, where a customer is allowed as much mineral water as he can drink, a small tumbler of very thin glass, holding from 7 to 8 fluid ounces, is used, and greatly adds to the pleasure of the draught. The profits on mineral waters are so great—especially on plain soda—that I have often wondered why druggists do not seek to push the sale of these. A glass of plain soda costs the druggist one-fifth of a cent. Why then would it not be a good plan for him to imitate the practice which has proved so popular at the mineral springs, namely, of allowing each customer who comes for plain soda to drink as many glassfuls at he wishes at a sitting without extra charge? The scheme at least seems to be worth trying.

As to those druggists, and they are not a few, who persist in asking ten cents for a glass of plain soda, it is difficult to understand how they can keep this price up. The only regular customers that can be obtained at this price are among the fashionable classes, and even men of means will look twice at a cent nowadays before spending it. It is not only the pauper and the millionaire who are willing to walk a mile to save five cents, but the middle classes as well know the difference between a dime and a nickel.

WHICH WATERS ARE MOST POPULAR?

Before concluding this article, a word in answer to the question as to what are the most popular mineral waters will be in order. The number of natural mineral waters is almost infinite, as are also their artificial reproductions. There are, moreover, a few specially prepared medicinal waters, compounded not in imitation of any natural water, but merely to obtain certain medicinal effects. Now it is impossible for the drug-

gist to keep many of these in stock; in fact, it seldom pays him to keep in fountains more than two mineral waters in addition to his plain soda. Vichy is, of course, the great standby. Geyser, Selters, and Kissingen are also frequently called for, but the demand varies so much according to locality that each druggist is obliged to be governed by his individual circumstances. It is seldom wise to try anything but Vichy water in portable fountains until assured that there is a real demand for any other mineral water.

FORMULAS.

The formulas given below are for making 10 gallons of mineral water—i. e., a sufficient quantity to charge the ordinary 10-gallon portable fountain. For the sake of convenience the different groups of substances in the formulas are separated by dashes. All the components above the first dash must be mixed together as directed in the first part of this article, and must then be added to the 10 gallons of water in the portable fountain, rocking the fountain all the while to secure a thorough mixture. The ingredients above the second dash must afterward be combined together and added to the fountain; and so on with each of the other groups in turn. The formulas given are designed to produce a very close imitation of the natural waters. Less elaborate formulas, which merely approximate the principal ingredients in the natural waters, are frequently used, and a few of these are given at the end of this article.

APOLLINARIS.

	Grains.
Sodium carbonate	2,835·27
Sodium sulphate	335·2
Sodium silicate	10·0
Magnesium chloride	198·1
Calcium chloride	40·2
Potassa alum	57·1
Magnesium carbonate, hydr	158·5
Iron sulphate	21·3

DEEP ROCK.

	Grains.
Sodium chloride	1,504·8
Potassium chloride	1,490·8
Sodium silicate	1,458·0
Sodium carbonate	521·1
Magnesium chloride	102·5
Calcium chloride	202·0
Hydrochloric acid	257·4

KISSINGEN.

	Grains.
Sodium phosphate	3·6
Sodium silicate	16·1
Sodium chloride	2,776·4
Potassium chloride	176·2
Sodium bromide	5·0
Sodium nitrate	57·0
Ammonium carbonate	1·6
Sodium carbonate	1,986·7
Lithium chloride	12·2
Calcium chloride	960·0
Magnesium chloride	14·9
Magnesium sulphate	1,213·8
Iron sulphate	46·1

SARATOGA VICHY.

	Grains.
Sodium carbonate	4,249·8
Sodium chloride	112·2
Potassium chloride	141·1
Sodium bromide	9·9
Sodium silicate	15·4
Lithium carbonate	11·0
Calcium chloride	736·3
Magnesium chloride	307·9
Barium chloride	6·2
Aluminum chloride	12·5
Iron chloride	0·39

The foregoing formulas are designed to give imitations as closely as possible to the analyses of the natural water, the analyses of the best chemists having been taken in every case. As in many cases the composition of the waters of the mineral springs differs at different seasons of the year, the mean or average of several analyses has to be taken as a standard.

In cases where a close reproduction of the natural waters is not required, much simpler formulas may be used, as for example in the three formulas given below:

VICHY.

Sodium chloride	6	drachms.
Sodium bicarbonate	5·25	ounces.
Ammonium carbonate	10	grains.
Sodium phosphate	25	grains.
Sodium sulphate	4	scruples.
Potassium sulphate	2	drachms.

Mix in half a gallon of water, and filter after standing twelve hours.

This solution may be kept a certain length of time, and when required be added to 10 gallons of water in the portable fountain and charged to 150 pounds pressure.

KISSINGEN.

Sodium bicarbonate	1	drachm.
Sodium chloride	8	ounces.
Ammonium chloride	4	grains.
Sodium sulphate	3	drs. 2 scr.
Magnesium sulphate	2	ounces.
Magnesium carbonate	4	drs. 1 scr.
Water	2½	pints.

Add to 10 gallons of water in a portable fountain and charge to 150 pounds.

SELTERS.

Calcium chloride	0·27	gm.
Magnesium chloride	0·8	"
Sea salt	0·23	"
Sodium phosphate	0·27	"
Iron sulphate	0·013	"
Sodium sulphate	0·4	"
Water	605·0	"

Charge to 150 pounds pressure.

N. B.—In the case of these last three mineral water solutions it is desirable to shake the solution thoroughly before adding it to the water in the portable fountain.—Bulletin of Pharmacy.

THE NATURE OF VALENCE.*

By F. P. VENABLE.

THE term "valence" is variously defined as the "combining capacity," "capacity of saturation," "quantitative combining power," or "chemical value of the atom." It is well known that the introduction of this idea into chemistry was due to the development of the type theory, a system which had at first a purely empirical basis. Sixty years ago there was still some hesitation as to the acceptance of the atomic theory or the need for such a theory. Much use was made of the term equivalent, which had been Wollaston's expedient for avoiding the difficulties arising from the full adoption of the theory of atoms.

Wallaston had been himself very far from consistent in the use of the term. The numbers called by him "equivalent weights" were not infrequently atomic and molecular weights and fully as hypothetical as the so-called atomic weights of Dalton. In the later use of the term it signified solely the numbers obtained by analysis without the introduction of any theoretical considerations. Thus, on analyzing ammonia, the ratio

$$N : H :: 4·6 : 1$$

is gotten, and therefore the equivalent of nitrogen is 4·6. Strange to say, the equivalent given by Wollaston corresponds with the present atomic weight, whereas the atomic weight given by Dalton corresponds with what would be the equivalent.

It is manifest that the idea of equivalents needed something more than the simple theory of atoms to make it clear and tenable. It embodied two distinct conceptions, and if we hold to an atomic theory we must introduce a further explanatory theory of the saturation capacity of these atoms. This is the theory of valence, or quantivalence, or atomicity, and without it the equivalents are purely empirical, and it is most difficult if not impossible to clear up the confusion connected with their use.

Returning now to the derivation of this idea of valence from the type theory, according to Wurtz,† the conception of valence was introduced into the science in three steps. First there was the discovery of polyatomic compounds. This term was first used by Berzelius in 1827,‡ he applying it to such elements as chlorine or fluorine where he thought several atoms of these elements united with a single atom of another element. The term was later applied by Graham, Williamson, and others to compounds.

The second step was the reference of this polyatomicity to what was called the state of saturation of the radicals contained in these compounds. This was largely through the work of Williamson and Gerhardt.

Thirdly, this conception of saturation was extended to the elements themselves. This was chiefly due to the work of Frankland upon the organo-metallic compounds. And so valence has come to refer to the number of atoms with which a single atom of any element will combine.

This conception has then been one of slow growth, gradually incorporating itself into the science as the necessity arose of devising a suitable explanation for accumulated observations. It was a logical outcome of and was evolved from knowledge acquired step by step. It was no mere speculation or hypothesis, such as that of Prout, evolved by the brilliant fancy or imagination of one man and suddenly appearing with scarcely a claim to foundation upon observed fact.

This conception enters into the chemical theory of to-day almost as fundamentally as the atomic theory itself. Its application is of everyday occurrence and of the most varied character, and yet chemists admit that the nature of valence is one of their chief puzzles and they have advanced but little toward its solution during the past half century. It is quite possible that the ideas to be advanced in the further discussion of this subject in this paper will meet with antagonism. Certainly they should be fully and freely discussed if they are worthy of it. I believe that they form a step toward the clearing up of the mystery of valence.

It is necessary, however, first to trace somewhat further the development of the original conception. One of its earliest and most important applications was to the study of the constitution of the compounds of carbon. Here Kekulé assumed for carbon a constant valence of four, and this idea is still dominant in theories relating to the constitution of these bodies. It was quite natural, then, that the first belief should have been in a constant valence. It was speedily found, however, that in certain cases, as in the compounds of nitrogen and phosphorus, this belief was scarcely tenable. There were efforts at making it hold good, as, for instance, a distinction was drawn between atomic and molecular compounds, but all of these suggestions have been proved unsatisfactory.

We unquestionably have to account for the existence of a compound with three atoms and another with five atoms in the cases of nitrogen and phosphorus and there are many similar anomalies. Here the valence seems to vary toward one and the same element. Cases might be multiplied to show also that it varies often toward different elements. Thus it frequently happens that the valence of an element toward hydrogen seems to be quite different from that exhibited toward oxygen. For a long time there was much straining to consider the valence of an element always the same, but this effort is, in large measure, abandoned now as unavailing, and chemists admit that valence is not constant but variable, and may even vary toward one and the same element.

The doctrine of valence has had much added to it about bonds, affinities, and linkage, the necessity for which one may well question. Certainly the misuse of the word affinity here, seeing its other and greater use, should be earnestly discountenanced. I am inclined to think that the other terms bring in false and misleading ideas which should be carefully guarded against. At any rate, all hypothetical talk about strong bonds and weak bonds, double bonds and triple is to be avoided.

If, then, valence varies, can it be an inherent property of the unchanging atoms? Experiments have shown that it varies with the nature of the combining element, that it varies with the temperature and with other conditions. It is not dependent upon the atomic weight in the same sense as other properties are dependent upon it. Thus in the same group the valence remains the same, whether the atoms weigh nine times as much as hydrogen or two hundred times as much.

We seem shut up to the conclusion that valence is not one of the primitive inherent properties of the atom but is relative. It is rather to be regarded as the resultant of the mutual influence of the atoms of the combining elements. The clear grasping of this idea is an important step forward. Unfortunately the distinction is not always made nor consistently adhered to.

It may not be amiss to cite here the utterances of Lothar Meyer in regard to the question of a constant or variable valence.*

"Since the aim of all scientific investigation is to exhibit the most variable phenomena as dependent upon certain active invariable factors taking part in them and in such a manner that each phenomenon appears to be the necessary result of the properties and reciprocal action of these factors, then it is clear that chemical investigation would be considerably advanced were it possible to prove that the composition of chemical compounds is essentially determined by the valency of the atoms and the external conditions under which these atoms react upon one another. The first necessary step in this direction has been made in the attempt to explain the regularities observed in the composition of chemical compounds, by the assumption of a constant power of saturation or an invariable valency of the atom. The opposite and equally hypothetical assumption that the valency is variable leads to no advancement.

"The first step toward progress in this matter would be made if some hypothesis as to the cause of this variability were proposed. This difference between the two attitudes has seldom been properly realized. While some chemists, accepting the constant valency of atoms, have attempted to deduce the varying atomic linking from one distinct point of view, others have considered it sufficient to have assigned to the atom of a particular element in one compound one valency, and in another compound a different valency, according as this or that value appeared the most suitable, and thus to have given a so-called explanation of the composition of the compounds in question. In this way the fact has been overlooked, that an arbitrary interpretation, carried out by means of chosen hypotheses, cannot be regarded as an attempt at a scientific explanation, but is nothing more than an expression of our ignorance of the causal connection of the phenomena. An explanation would require that the different valencies assigned to one and the same element in different compounds should be traced to a distinct cause. If, for instance, it is stated that carbon in carbon dioxide possesses double the valency which it possesses in carbon monoxide, such a statement is no explanation of the fact that an atom of carbon in the former compound is combined with twice as much oxygen as in the latter, for such a statement is merely a paraphrase which hides its incompetency by assuming the form of an explanation. Although this may be perceived without further remark, still it has frequently occurred during the past few years that similar paraphrases have not only been proposed but also accepted as real explanations of such phenomena. Just as it was formerly supposed that the assumption of a vital force dispensed with a more complete investigation of the phenomena of animal life, so many chemists have of late thought that they possessed in 'variable valency' a means of explaining the varying stoichiometric relationship which would satisfy all claims. Such deceptions can only retard the advance of the science, since they prevent an earnest and thorough investigation of the question, whether each atom is endowed with a property determining and limiting the number of atoms with which it can combine, dependent upon the intrinsic nature of the atom and like it invariable; or whether this ability is variable and with it the nature of the atom itself."

It is not strange that this line of reasoning should lead Lothar Meyer to doubt the unvarying nature of the atom itself, and thus losing his grasp upon one invariable to make sure of another. He says: "It is by no means impossible that the magnitudes which we now style atoms, may be variable in their nature."

It will be an unfortunate day for chemists when the belief in the unchanging atom is given up. Chaos will indeed enter into all of our theories when this, the foundation rock, is left at the mercy of every shifting tide of opinion and can be shaken by all manner of unfounded hypotheses.

The case cannot be so hopeless as to necessitate calling to our aid so dangerous a doctrine. Before turning to such an expedient, let us first make all possible use of our atomic theory as it stands. The extension of this theory teaches that the atoms are endowed with motion, and this motion probably varies in velocity and phases with the different elements. So too when the atoms unite, the resulting molecule has a certain motion peculiar to it, while the atoms composing it have an intra-molecular motion in which their original motions are probably modified by their influence upon one another. It is quite manifest then that a molecule, in order to exist, must maintain a certain equili-

* Address, as chairman, delivered before the North Carolina Section of the American Chemical Society. Reprinted from the Journal.

† Histoire des doctrines chimiques, p. 69.

‡ Jeb. d. Chem. 7, 69.

* Modern Theories of Chemistry, Eng. trans., p. 305.

brium and harmony between these various motions, and that there can be all degrees of equilibrium from the very stable to that which may be upset by the least disturbing influence from without.

It seems to me that herein we have a full and satisfactory means of explaining the various problems connected with the conception of valence. The question as to whether the atoms of two elements will unite is decided by affinity, which is in some way connected with the electrical condition of those atoms. There is no apparent connection between this and valence. The number of atoms which enter into combination forming one molecule is purely a matter of equilibrium and is dependent upon the motion of those atoms. Thus a phosphorus atom unites with chlorine atoms because of a certain affinity between them. The number of chlorine atoms with which it will unite depends upon the possibility of harmonizing the respective motions. As the temperature may affect these motions and also impart a more rapid molecular motion, it is evident that the harmony, or equilibrium, will depend upon the temperature and that a temperature may be reached at which no harmony is possible and hence no compound can be formed. The phosphorus atom mentioned can, as we know, form a stable molecule with five atoms of chlorine. On increasing the temperature this becomes unstable and only three atoms can be retained. Neither with four atoms nor with two is there harmony of motion. A sufficiently high temperature may prevent any harmony of motion whatever being attained and hence union may become impossible.

As to other influences than those of temperature, we can see that the equilibrium between the atom of phosphorus and the five atoms of chlorine may be upset by such a molecule coming within the influence, electrical or vibratory, of a molecule of water. The atoms must rearrange themselves for a new state of equilibrium and so an atom of oxygen takes the place of two atoms of chlorine, giving again a condition of harmony. In other cases the motion of the molecule of water may be of such a character as to directly harmonize with that of the original molecule and so to enter into equilibrium with it, a definite number of such molecules of water affording a condition of maximum stability. This we call water of crystallization. Such molecules would be more or less easily separated by an increase of temperature and where several molecules of water were attached the highest temperature would be necessary for freeing the original molecule from the last water molecule.

A carbon atom finds its most perfect state of equilibrium where four atoms of hydrogen or their equivalents move in harmony with it. But there is a second state of equilibrium where only half that number of atoms are moving with it. This state does not seem to be a possibility where these are hydrogen atoms, but is readily possible where the equivalent number of oxygen atoms is concerned. Such a molecule, however, is always in a condition to take up additional atoms until its highest equilibrium is reached, and in doing this it proceeds by the regular steps needed for bringing about a harmony of motion. A molecule in a lower state of equilibrium we have become accustomed to call unsaturated, calling that one saturated which is in its highest state of equilibrium. The further application of this hypothesis is easily made and need not be dwelt upon here. It will be helpful in many ways.

This theory of valence makes it clear why it should vary toward the same element under different conditions. It is also clear that it might vary toward different elements as these are very possibly possessed of different motions. It is further evident that it is in accord with the conclusion that valence is not an inherent property of the individual atom, but is the resultant of the influence upon each other of the combining atoms.

Only one point remains to be considered: Why do the elements of the same group have practically the same valence? The nearest answer to this, and it seems satisfactory, is that they are all possessed of the same phase or kind of motion. In other words, the natural division into periods gives us seven or eight more or less different phases. These are, in large measure, independent of the atomic weight. And so the elements in any given group have the same tendency toward similar states of equilibrium in forming compounds with any other element, as hydrogen or oxygen. Some elements, as copper, mercury, tin, etc., are peculiar in that they may change their phase of motion under certain influences, acting then as if they belonged to different groups and entering into totally different states of equilibrium in forming their compounds.

Lastly, it is possible for a combination of atoms of different elements, as NH_4 or CN, to have such molecular and intra-molecular motion that, although not in a state of equilibrium themselves, they are capable of entering into such states as the single atoms of elements do, having apparently similar valence.

I might develop this theory much further, but it is unnecessary now. Enough has been said to show that such an application of the atomic theory is legitimate and is most highly important as a step toward the clearing up of the problems springing from the conception of valence and from the periodic system.

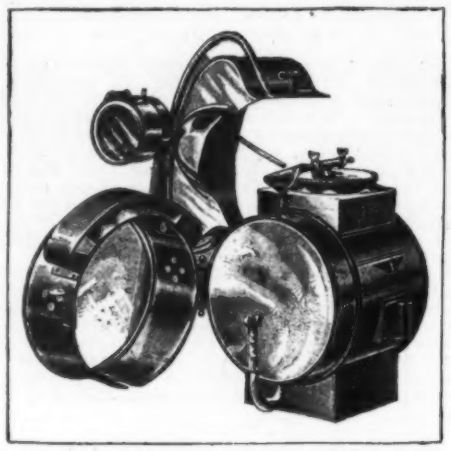


FIG. 1.—DASH-LAMP FOR AUTOMOBILES.

PORTABLE ACETYLENE APPARATUS.

WHAT "overproduction" is in the use of acetylene is well known. It is an excess of gas, which, when the apparatus is at rest, forms through the action, upon the carbide, of the humidity retained by the lime. Such excess of gas is always annoying. In certain cases it is allowed to escape into the atmosphere; but such a solution of the problem is not very satisfactory either from the view-point of economy or odor. In other cases, it is stored up in a holder; but, since this greatly increases the bulk of the apparatus, it is a matter of interest to seek a method of suppressing the overproduction altogether. This problem has been very happily solved by the use of "acetylithe," an invention of Dr. Letang and M. Serpollet. This preparation is made by coating ordinary carbide of lime with glucose, after a long immersion in petroleum. The body thus formed possesses very valuable properties. An average amount of humidity does not attack it, and in order that a disengagement of gas may occur, it must be completely submerged. Moreover, in measure as it is attacked, the carbide dissolves in the water and leaves a residuum of soluble tribasic sucrate of lime.

The apparatus in which this material is employed operates upon the principle of the hydrogen lighter. Fig. 2 represents a portable acetylene street lamp that we saw in operation at the Night Fêtes at the Garden of Acclimatation. Here R is a receptacle filled two-thirds full of water, and into which enters a cylinder, G, which is connected with the cover and provided at its lower part with an acetylithe basket, P. When the cylinder, G (the cock, r, being closed) is immersed in the receptacle, the air that it contains offers an obstacle to the ascent of the water to the basket. If, then, the cock, r, be opened, the air will escape and the water will flood the bottom of the basket, P. At this moment the disengagement of the gas will begin. It will be remarked that, as the charge descends gradually in dissolving, the level of the attacking water will remain sensibly the same. Consequently, the pressure will vary so little that the eye can perceive no difference in the light.

In order to extinguish the light, it suffices to close the cock, r. As the gas formed cannot escape, it forces the water to descend below the level of the basket, and the disengagement immediately ceases.

It will be seen from this description that the volume of gas corresponding to the charge of the basket may be utilized at will in a continuous or intermittent manner, even at intervals of several days, and that, too, without any loss of gas or violent disengagement, since the humidity does not suffice for an attack. Before flowing to the burners, the gas passes into a purifying tube K, which is filled with ordinary carbide placed between two layers of cotton wadding. This simple precaution allows of the gas being sent into a service pipe without any fear of a deposit of impurities or a condensation of water.

Here, then, we have an apparatus of very simple management, and one in which there is no storage of gas. Its bulk and weight, reduced to a minimum, give it great power while rendering it eminently portable. The height of the generator represented in Figs. 1 and 2 is 18 inches and its diameter 8. It is capable of giving for an hour and a half a luminous power of 500 candles, in the apparatus for projections, or of 100 candles for six hours in the apparatus for street lamps.

M. Bleriot, grantee of the Letang and Serpollet patents, is applying apparatus of the same kind to the intensive lighting of automobiles, and his self generating dash-lamps (Fig. 1) are powerful enough to permit the boldest drivers to let out all their speed at night. It is these projectors that, placed in front of the automobiles of the Paris-Bordeaux race, permitted of the speeds of 33 and 36 miles per hour obtained by the bicyclists.

The same method of lighting is applied by the Compagnie Générale des Omnibus upon the Louvre-Saint-Cloud line. The apparatus, placed under the stairway to the roof, sends the purified gas into an expander situated in front of the car, and thence to the lanterns of the interior, platform and roof. We have here a very interesting application of the new light. Let us hope that this example will be followed by other transportation companies.

For the above particulars and the illustrations, we are indebted to La Nature.

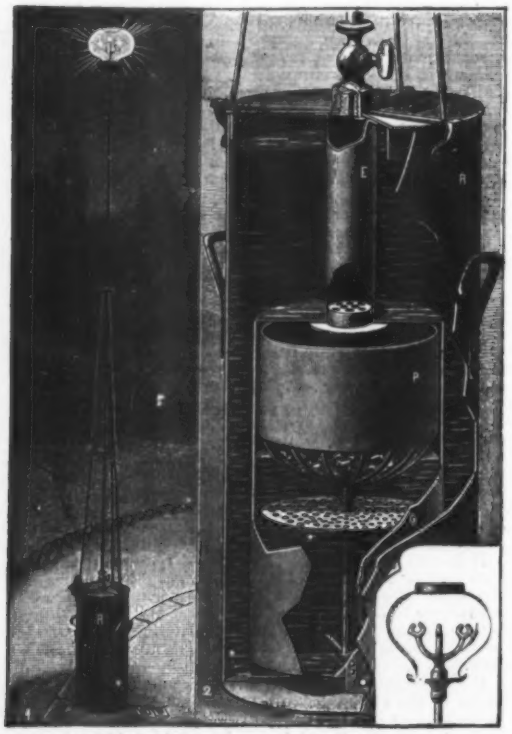


FIG. 2.

1. General view of a portable street lamp. 2. Section of a portable generator for street lamps. The figure in the cartouche represents a photographic projector.

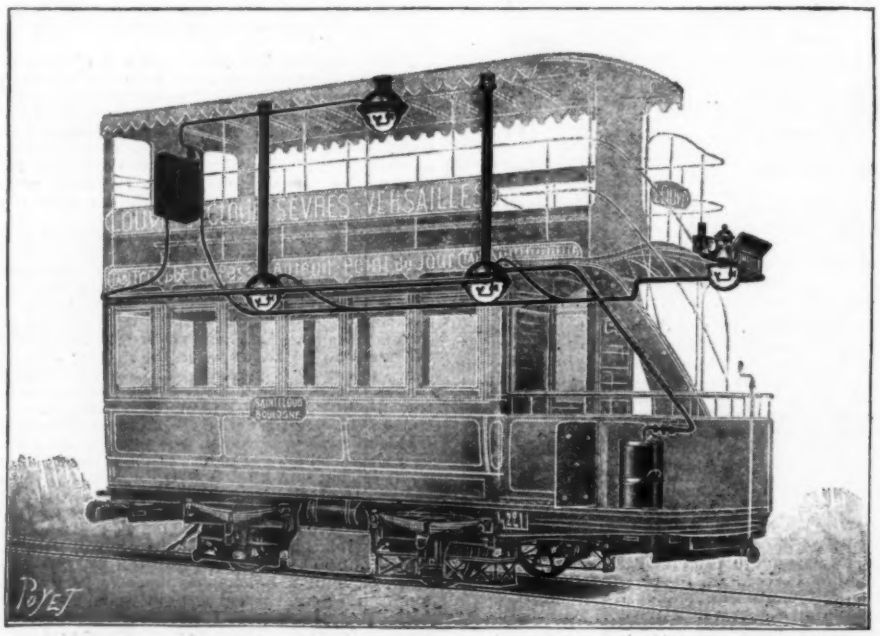


FIG. 3.—GENERAL VIEW OF A STREET CAR LIGHTED WITH ACETYLENE.

THE MANY PRODUCTS OF COAL TAR.

THE wand of the alchemist becomes more wondrous in its transforming powers every day. No tale in the Arabian Nights, no story of the wondrous treasures taken by mystic power from magic nutshells, surpasses what science is doing to-day.

Science, the wizard of the century, touches with his fairy wand the black, viscid coal tar from the gas retorts, and coal becomes not only a source of light and heat, but an arsenal of colors, a buffet of dainty tastes, a medicine chest for suffering humanity, a storehouse of new foods and exquisite perfume, a source of powerful explosive for war and so many other miraculous powers that the telling challenges credence. From the 140 pounds of gas tar in a ton of coal, science to-day makes aniline dyes numbering over 2,000 distinct shades, many of them being of exquisite delicacy, so that vegetable dyes are almost displaced.

Of medicines, antiseptic, hypnotic and fever-allaying preparations, it furnishes antipyrine, ammonia, antifebrin, asporal, carbolic acid, diuretin, dulcin, euphorin, exalgine, hypnol, malarin, naphthaline, phenatecin, phenol, salol, sulfonal, trional, hylene and a host of others.

It furnishes perfumes—queen of the meadows, cin-

namon, bitter almonds, camphor, wintergreen and thymol. It has given to the world bellite and picrite, two powerful explosives. It supplies flavoring extracts that duplicate the taste of currants, raspberries, pepper, vanilla, etc. It is the housekeeper's ally, with benzine and naphtha, the insecticides. It supplies the farmer with ammoniacal fertilizers. It has given to the photographer his two developers, hydroquinone and eikonogen. It makes the anatomist its debtor for a most wonderful stain for tissues. It contains the substance which tints the photographer's lens. It yields paraffin, creosote, pitch; material for artificial paving; saccharin, a substance 300 times sweeter than sugar, and saccharin-amide, still sweeter; lampblack, material for red ink, lubricating oils, varnish, resin, almost our entire supply of ammonia, and hundreds of other things—all these science brings forth from this coal tar.

By means of its products—this waste that surpassed its uselessness only by its offensiveness—we can make preserves without either fruit or sugar, perfumes without flowers, and coloring matter without animal or vegetable aid of any description.—The Humanitarian.

PORTABLE RAIL SAW.

THIS tool is designed for cutting rails or girders up to 1[illegible] inches in depth. It is transported by two men

PORTABLE RAIL SAW.

using two round bars passing through eyes, one of which is seen, and corresponding holes in the casting. There are adjusting feet with stout bolts and washers for regulating the saw to the particular depth of rail to be cut. These are seen to the front of the illustration. Underneath are clamps which approximately fit the rail section, and by means of the hand lever shown at the side, these are screwed up easily to obtain a firm grip on the rail. When this is done, the small handle at the top is used for bringing the saw blade close down to the rail, and then the two men turn the large crank handles, driving the saw steadily forward by double-reduction spur gear, one wheel and pinion of which is clearly shown in the illustration.

The second pinion consists of a special-shaped star wheel, gearing into the teeth of the saw, so that the power is transmitted to the saw, not through its axis, but through its periphery, enabling a very powerful cut, similar to that of a planing machine, to be obtained. Except for very heavy sections, this work is not beyond the capacity of one man. At the back of the machine is an automatic feeding gear, which drives by worm and wheel, both of which can be seen at the top of the illustration, and feeds the saw steadily forward. An ample lubricating arrangement is provided with a guiding wire directing the lubricant on to the periphery of the saw blade. Rails weighing up to 90 pounds per yard can be cut through within ten minutes. When required for cutting at an angle, the rail clamps are set round to the desired angle. In order to enable good cutting to be maintained it is desirable to keep the teeth all of even length and sharp, and Messrs. Laing, Wharton & Down, of Bond Street, London, the agents for this saw, provide with it a special grinding apparatus; this consists of a plate with a pin which passes through the center of the saw blade; proper stops are also provided, and arrangements made for topping and for gulleting the saw blades, the grinding being effected by a high speed emery wheel.—We are indebted to London Engineer for this interesting article.

THE LEHMANN ROTARY PUMP.

THE styles of double rotary pumps are so numerous and so different that it would seem as if it would be difficult to introduce into such apparatus any arrangements that were new and truly advantageous from the view-point of operation and rendering. Nevertheless, this has been done in the pump devised by Herr Lehmann of Gilenburg and represented in the accompanying figures, borrowed from the Revue Industrielle. Let us say at the outset that this apparatus is adapted for the raising of both thick and thin liquids and operates equally well in both directions of revolution.

As may be seen from Figs. 1 to 3, the pump chamber is formed by the intersection of two superposed cylinders of unequal diameters, the upper one of which contains a stationary drum hollowed out beneath, in order to permit of the passage of a rotary drum provided with wings and called a "distributer."

In the annular space formed between the upper drum and the pump chamber revolve four hollow and equidistant pistons, Z_1 Z_2 Z_3 Z_4, connected laterally by disks keyed upon the driving shaft (Fig. 4), which, through equal pinions, actuates the shaft of the distributer.

The essential innovation made in this pump consists in the use of two channels, Y Y_1, formed in the stationary drum. In order to understand the advantages that are obtained from such an arrangement, we must first examine the inconveniences that would occur did no such channels exist. The tubulures, S and D, shown in the figures are respectively designed for suction and forcing. The direction in which the pistons revolve is shown by the arrow between the pistons, Z_4 and Z_3, in Fig. 2.

At the inception of a period of suction, the piston, Z_1, makes its exit from chamber, K, of the distributer, and, in concert with Z_4, sucks the liquid until Z_1 reaches the position shown in Figs. 1 and 3. The liquid contained in the space between Z_1 and Z_4 afterward flows toward the tubulure, D, and then, when the latter is uncovered by Z_4, the forcing of the liquid begins.

These effects are reproduced during a single revolution as many times as there are pistons in the pump, say four in the type represented.

Let us now examine the peculiarities of the operation. Every time a piston enters a chamber, K, of the distributer to effect a forcing of the water, or makes its exit therefrom to produce a suction, the liquid can flow only through the passage, Y (Fig. 2), formed between the distributer and the piston under consideration; but at the moment that the latter enters into play, this passage is precisely minimum. The result is that on the side on which the forcing is done, the liquid contained in the chamber, K, is compressed and violently expelled from the latter, thus producing a prejudicial acceleration in the motion of the ascensional column.

On the contrary, on the side on which the suction takes place, the piston creates in the chamber, K, a depression, through the effect of which the liquid flows through the passage, Y, with an excessive velocity that causes a loss of live force in the distributer, and in the ascensional column through repercussion.

Since a piston enters a chamber and makes its exit therefrom in an interval of time that varies from $\frac{1}{18}$ to $\frac{1}{12}$ of a second, this state of things gives rise to strong shocks that rapidly succeed one another. The result is a premature wear in the parts of the pump, and a pure loss in the consumption of energy.

It is in order to remedy such inconveniences that Herr Lehmann has provided the stationary drum of the pump with the channels, Y and Y_1.

Upon an examination of Fig. 2, it will be seen, in fact, that the entrance of the water into the chamber no longer occurs through the passage, Y, solely, but also through the top of the channel, Y. On the other side, the channel, Y_1, performs the same role with regard to the forcing of the water.

The sections of these channels are such as to prevent any acceleration or retardation in the motions of the ascensional column, and shocks are thus avoided.

These channels present still other advantages. When, upon the right, the chamber, K, is closed, the liquid that it contains is at the forcing pressure. Now, in the ordinary arrangement, this chamber afterward opens suddenly to the suction, which, by this fact, is interfered with. In suctions of water from a great depth, this is shown by an appreciable diminution in the rendering, and, consequently, in the useful manometric effect. In this regard, the channels act as equalizers or compensators of pressure. On the one hand, the channel, Y_1, puts the chamber, K, in communication with the space between Z_3 and Z_4 (Fig. 1) for an instant, so that the pressure of the water is equalized therein and reaches sensibly that which exists at the time of forcing. No shock is therefore produced at the moment at which Z_3 debouches thereinto.

On another hand, scarcely is Y_1 closed when Y opens (Fig. 3) and communicates to the water contained in the space between Z_1 and Z_4 the pressure of the chamber, K, which after this may open into the tubulure, S, without inconvenience.

The role of these canals is consequently very favorable to the rendering. Moreover, there are arrangements for relieving the distributing drum from the pressure that tends to cause prejudicial friction upon the pump chamber. Such arrangements also permit the forcing pressure to be distributed at the proper moment through the drums of the chamber. When the latter open into the tubulure, D, the water that they contain is at an equality of pressure therein, and shocks are likewise avoided. Finally, it is well to remark that the very operation of the hollow pistons, Z, contributes toward rendering them tight. By reason of the velocity with which they revolve, the water that fills them acts with a high pressure in the grooves formed in their two circular faces, and forms hermetical joints.

In conclusion, we may state that of these pumps the size capable of discharging 150 gallons a minute at a velocity of 160 revolutions occupies a space of 3·75 × 1·25 feet and weighs 860 pounds. The expenditure of

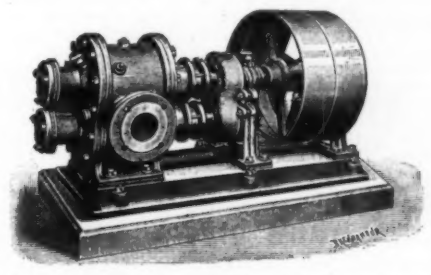


FIG. 4.—GENERAL VIEW OF THE LEHMANN ROTARY PUMP.

energy necessary for the raising of water to a height of 33 feet amounts, according to the manufacturer, to 1·7 horse power.

Study of the Black Diamond.—We find in nature, both in Brazil and at the Cape, transparent diamonds containing inclosures of various forms. These inclosures may be of different nature, but the most numerous are black, and when abundant afford the variety of crystallized carbon of a fatty aspect which is known by the name of "black diamond." We are able to demonstrate that these black inclosed matters are due to a variety of carbon differing from the diamond in the following respects: A black diamond of 2·2365 grammes, presenting some small flaws, but transparent, was inclosed in a piece of cloth, placed on an anvil, and broken with the hammer. It was split with the first shock, and yielded very distinct pointed octahedra. We reduced the whole to fine powder in an Abich mortar, and this dust, of a blackish gray, is found under the microscope to be formed of fragments. We heat, then, about 1 centigramme of this powder in a tube of Bohemian glass traversed by a current of oxygen at a temperature lower by 200° than the temperature of combustion of the diamond. The experiment lasts half an hour. We observe very distinctly a slight escape of carbonic acid, which soon ceases, and which is shown by baryta water. After cooling, the diamond has lost its gray tint and has become white. The black matter which was contained in this diamond therefore burns in oxygen, yielding carbonic acid, and the diamond resumes its transparency. The experiment succeeds only with black diamond reduced to a very fine powder.—Henri Moissan, in Chemical News.

The value of the barks of certain acacias for tanning purposes has long been recognized, and in Australia the native forests of acacias or "wattle trees," as they are called, have for a long time furnished nearly all the tanning material used in the various colonies. Not only is the native growth utilized in the Australian colonies, but the culture of the most valuable species has been carried on and found profitable.

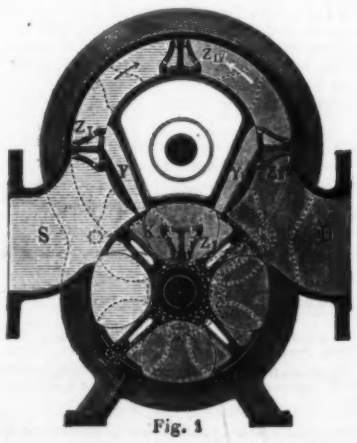


Fig. 1

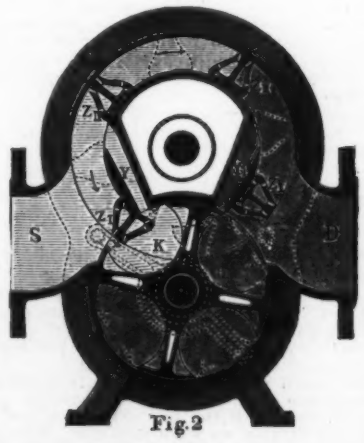


Fig. 2

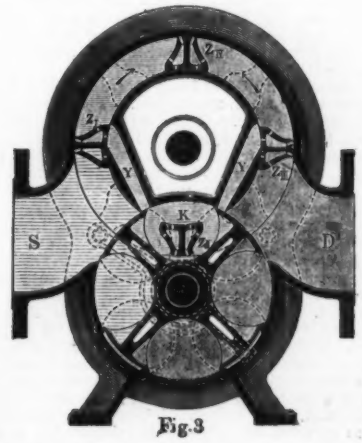


Fig. 3

VERTICAL SECTIONS OF THE LEHMANN ROTARY PUMP.

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

French Market for American Iron.—Consul Brittain writes from Nantes, July 10, 1899:

There have recently been many inquiries for the names of the leading firms in the United States that manufacture various kinds of machinery. A number of sales of American machinery have been made during the past year. Heretofore, considerable machinery used by the shipbuilders of Nantes has been purchased in England. English manufacturers have two advantages over those of the United States—first, their nearness to this market; second, the advantages accruing from the minimum tariff rate. For machine tools weighing over 1,000 kilogrammes (2,204 pounds), the maximum duty is 15 francs ($2.89), the minimum 10 francs ($1.93) per 100 kilogrammes (220·46 pounds); weighing from 250 to 1,000 kilogrammes (550 to 2,204 pounds), maximum 20 francs ($3.86), minimum 16 francs ($3.08); small tools, weighing less than 250 kilogrammes, maximum 70 francs ($13.50) and the minimum 50 francs ($9.65) per 100 kilogrammes. The difference on structural iron or that used for shipbuilding is not so great, the maximum being 6 francs ($1.15) and the minimum 5 francs (96 cents). The recent augmentation in prices and the scarcity of a visible supply of structural iron in this part of France makes this an opportune time for the American manufacturer to invade this market. The nearness of the English manufacturer has given him an easy victory in the past, but the shipbuilders of the Loire have come to the conclusion that if the American iron manufacturers can sell iron in England and in English colonies, it is at least worth while to get our prices.

I believe if the American manufacturer were on the ground with prices and terms, he could capture some orders. There are three shipyards at Nantes, where there were constructed last year forty-two iron vessels, varying in tonnage from 3,000 downward. At St. Nazaire, 30 miles west of Nantes, there are extensive shipyards, where some of the largest vessels in the service of the Compagnie Générale Transatlantique were built. About two weeks since, a large war vessel for the government of Japan was launched at St. Nazaire. American manufacturers of structural iron would do well to correspond with Julun Lanoé, of Nantes, an extensive dealer, who is anxious to obtain American prices on bar, structural, and plate steel and iron.

Congress of Charity at Paris.—The Department has received a note from Ambassador Cambon, dated Washington, July 15, 1899, to the effect that an international congress of public assistance and private beneficence is to meet in Paris from July 30 to August 5, 1900. The French government is to be officially represented, and foreign governments are requested to send delegates to the congress. A circular issued by the promoters has the following extracts from the general regulations of the congress:

"The questions discussed during the sessions of the congress will be the subject of printed reports, which will be distributed to members at least fifteen days before the opening meeting. So far as possible, each question will be treated by French writers, foreign writers, and general writers. These writers will be chosen by the commission of organization. Other questions relating to public assistance and private beneficence may be submitted for discussion. Authors are requested to send papers to the general secretary three months before the opening of the congress.

"The congress comprises four sections: (1) Childhood; (2) the sick, the infirm, the incurables, the aged; (3) the able-bodied poor, other relief than that of assistance by furnishing work, general questions; (4) works of assistance by furnishing work. Other subjects to be considered are: The working and efficacy of relief at the home; compromise between public and private assistance; treatment and education of children in reform schools, schools of correction, etc.; character of works of relief by furnishing work; should these not be considered works of private beneficence? assistance to indigent consumptives (measures of relief, whatever the medical treatment may be).

"The language of the congress will be French. Only members are permitted to submit communications, to be present at the sessions, or take part in the discussions. The fee for membership is 20 francs ($3.86).* It is to be devoted to payment of the publication of the lectures, etc., delivered in the congress."

The adhesion of all persons interested in relief work, public or private, is requested.

American Fruits in the Orient.—Numerous inquiries have been made of me by manufacturers and dealers in fruits as to the condition of the crop here in China, the prospects for selling orchard products, the size of packages preferred, manner of packing, etc., says United States Consul A. Burlingame Johnson.

I have answered specific inquiries direct; but since the inquiry just received from the State Board of Horticulture, of Portland, Ore., covers the entire field, I make this general response, hoping it will receive the attention from our dealers which the importance of the trade merits.

The condition of the fruit crop in China has little or no effect upon the importation. The tropical fruits do not come into competition with the product of the United States; and in the more northern districts, where northern fruits might be grown, the quality of the products, owing to the ignorance or indifference of the people, places them outside the pale of competition with good fruits.

The only exception to this rule, possibly, consists of grapes grown in the north of China, some varieties of which are excellent.

There is a steadily increasing demand among the natives for foreign fruits, whether canned, dried, or preserved. The European population look to these imported fruits almost exclusively to supply their tables. Tinned pears, peaches, and apricots come principally from America, while preserved fruits, jams, and dried fruits still come largely from Europe. The reason is apparent. The American manufacturer will not, or does not, meet the conditions required. Since there are no peaches or pears in Europe which can compete with those from California, the oriental merchant has no choice; in other lines he is not so restricted. Prunes and raisins are largely used. The dried fruit is put up in bottles and sealed. In no other way can it be shipped to the tropics without great loss, as the humidity of the climate or insects will soon render it unsalable. No fruits, biscuits, crackers, or any other food product can be safely shipped to central or southern China or the Philippine Islands without being sealed in glass bottles or tinned. The English and Continental merchants and manufacturers understand this, and put up their fruits accordingly. If tinned, the tins are either painted or varnished to prevent rust and consequent loss to the merchant.

The American manufacturer has found a market for his product without these extra expenses, and is slow to meet the demand; hence dried fruits, jams, and tinned fruits are usually bought in other countries, where these necessary details are looked after.

American oatmeal finds little market here except via England, where it is put up in tin boxes of 2 to 4 pounds each.

If our exporters of fruit expect to hold the market in the Philippines or to gain a better footing in China, they should begin by studying the conditions and promptly meeting them.

Prices realized in China for fruits justify the expense necessary to put them up so as to insure their being in good condition when they reach the consumer.

Bonds in Guatemala.—Minister Hunter sends from Guatemala, July 15, 1899, translation of a recent decree in regard to the conversion into bonds of accounts against the Guatemalan government, as follows:

"EXTENSION OF TERM FOR THE PRESENTATION OF DOCUMENTS.

"Executive Palace,
"Guatemala, July 5, 1899.

"The Constitutional President of the Republic, considering that various persons have presented themselves, soliciting an extension of the term fixed by Article I of the governmental decree, No. 594, of May 23 last, for the presentation of documents of credit against the exchequer, because in the time fixed it has not been possible to obtain their legalization by the respective offices, owing to the fact that many of them are found outside of this capital, and because in some instances the documents which justify the credits exist outside of this country, decrees:

"That the documents of credit treated of in Article I of the legislative decree No. 440 may be presented to the General Direction of Accounts from the 1st to the 31st of October of the present year for their bonification, and that upon the expiration of this new term the holders of those credits will be subject to article 2 of the above-cited decree, No. 594.

"Let it be communicated and published.

"ESTRADA C.

"Section of State in the Department of Finance.
"PEDRO GALVEZ PORTOCARRERO."

Notes from Dawson City.—Consul McCook sends the following from Dawson City, under date of July 8, 1899:

About 2,000 people have left this place for St. Michaels during the past month, fully 1,800 of them bound for Cape Nome gold fields. The fares to St. Michaels for second-class passengers have been reduced to $35 with meals. One steamer took 235 passengers, some at the rate of $15 without meals, and yet even at this low figure there are several hundred in Dawson who cannot go. On account of competition on the Upper Yukon, fares to Seattle are now selling for $45, and to Lake Bennett at $15. Some $3,250,000 worth of gold dust has already been shipped from Dawson City to Seattle and San Francisco via St. Michaels.

It has been proved this winter that only very rich mines can be worked at a profit without machinery on account of the high price of labor and living. Hydraulic mining will soon have to be adopted in this country. The opportunity is now open for capitalists to buy claims to operate with machinery, which will yield rich returns for the money invested. Many representatives of English companies are now looking over the ground. The poor man's chances so far as this country is concerned are gone. In Alaska many opportunities are still open to a man of grit and perseverance. I understand second-class mail matter is allowed to come in now while navigation is open. All who have friends here should take immediate advantage of this opportunity, and send magazines, papers, books, etc. (nothing too bulky, however), up to September 10.

American Candy in South Africa.—The small amount of sugar imported into this colony from the United States, as compared with other countries, led me recently to make an investigation. I find, says Consul General J. G. Stowe, of Cape Town, that the few candy makers here (manufacturers of what is known as "fine candy") state that American refined sugar "will boil by common fire and make whiter, cleaner, and better candy than that raised in Natal, Mauritius, and, in fact, all other countries." I am unable to ascertain the imports of refined sugar alone, for the reason that candy is included with refined sugar in the returns; but the amount of both imported into and through Cape Colony from the principal countries of export is as follows:

Country.	1895.	1896.	1897.	1898.
	Pounds.	Pounds.	Pounds.	Pounds.
United Kingdom	4,357,363	1,343,383	1,517,109	1,465,314
Germany	1,927,153	3,538,017	5,794,083	4,013,744
Holland	968,555	2,210,140	2,198,053	1,375,781
Belgium	.....	.....	119,992	887,850
United States	311,504	225,483	319,669	244,194

The total imports do not seem to have fallen off to any extent. In 1895 they were 7,597,649 pounds; in 1896, 7,389,801 pounds; in 1897, 9,976,645 pounds; in 1898, 7,963,074 pounds. The decrease in 1898 was caused by the increase of production in Natal.

A very small amount of fine candy is made here, principally the cheaper or "hard" varieties, and, consequently, nearly all the fine candies as well as the bulk of the cheaper sorts are imported. One does not find here the superior candies that are known in America, and no effort seems to have been made to introduce them. Recently, through the work of this consulate, a trade has been opened up with manufacturers of the United States and several heavy shipments are now on the water. I present these few facts to show that there is a market here, if prices are right. While I cannot obtain figures showing the importations from the United States for the years preceding 1895, I am told that during the period when the bounty given by the United States to sugar growers was in force, nearly double the amount of refined sugar was received from that country.

Progress in New Caledonia.—During the past fiscal year, certain noteworthy changes for the better have taken place in my consular district, says United States Consul P. E. Wolfe, of Nouméa.

A Mr. Bernheim, owner of extensive mining property in the northwest of the colony, recently completed a narrow-gage line of railway, 40 kilometers (24·85 miles) in length. The rails and rolling stock were imported from France.

Two other lines are in course of construction, one of 40 kilometers, on the east side of the island, at Kouaona, and one of 30 kilometers (18·6 miles), close to Bourail, a small town north of Nouméa. A line of 150 kilometers (92 miles), to be built by the local government, will probably be commenced in February next, the contract for which I hope will be secured by a United States firm. A fifth line, in the extreme north, is in contemplation.

The mining industry is in a flourishing condition; nickel, chrome, cobalt, and copper ores are being rapidly extracted. From every quarter of the globe orders for minerals are received by the leading firms, and I am informed by the director of Le Nickel, at Nouméa, and the general manager of the firm of L. Ballande & Company, that they have taken important orders from the United States, and shipments are being prepared for that country.

The inspector-general of infantry, who arrived from France some time ago, has been examining the coast defenses. New forts are to be erected and the existing ones strengthened. Work in connection with this movement has already been started. Several million francs are to be expended, and the general trade of the colony cannot fail to be benefited.

Mining and Railway Concession in Venezuela.—The Department has received from Consul Plumacher, of Maracaibo, under date of June 23, 1899, translation of a recent act of the Venezuelan government renting the coal mines, railroads, and wharves of Guanta (State of Bermudez, Bolivar district) to Lanzoni, Martini & Company, of Rome, Italy. The contract, it appears, is to run for fifteen years, and the company will pay 104,000 bolivars ($20,012) annually in monthly installments and 50 centimes (9·6 cents) for every ton of coal extracted, this money to be reserved, in order to meet any future claims on the property. The company is not to increase the price of the coal used by the government on its ships, which price is to be 25 bolivars ($4.82) per ton. The railway rates are to remain as at present. The government is to keep closed, during the period of the contract, the port called El Rincon, or Guzman Blanco, except for such articles as earthenware, wood, fish, vegetables, and the like, that cannot pay the landing and railway charges. The State of Bermudez and the government are to have a rebate of 50 per cent. of the passenger tariff for their employes on commission and on freight. Mail is to be carried by the railroad free. Work is to be begun within four months and finished in eight months more. Exemption from duties will be granted to the machinery and articles used in the exploitation of the mines and railway. Work is not to be suspended for more than six months, under fine of 20,000 bolivars ($3,860). A guaranty of 50,000 bolivars ($9,650) is to be deposited in bank by the company, to be forfeited in case of non-execution of contract. The contract can be renewed for a further period of ten years after the expiration of the fifteen years if the company has complied with all the conditions specified. Native labor is to be preferably employed. The enterprise is to be free from taxes and employes are to be exempt from military service.

German Trade with Uruguay.—Consul Monaghan, of Chemnitz, under date of June 22, 1899, writes:

The German press announces that Uruguay and Germany have agreed to go on trading on the basis of the commercial and shipping treaty of June 20, 1892, under which each is guaranteed the same rights as the most favored nation. Germany, however, yields all claims to participation in the special concessions to citizens and goods of the United States of Brazil, Argentine, and Paraguay. In 1897 Germany took from Uruguay imports worth $2,570,000. Of these, $1,569,134 were for extracts of meat, on which there are no tariff concessions. Skins and sheeps' wool imports amounted to $688,296. Germany's exports to Uruguay were valued at $1,321,852. They did not suffer from differential duties, Uruguay having no tariff treaties with other countries. Up to date Uruguay has done nothing to speak of in the way of manufactures. Only agriculture has been developed. Textiles are among the most important classes of imports. The people that can send wares cheap, good, and suitable to Uruguay's needs will win her markets.

* A copy of the form of membership, transmitted with the note from M. Cambon, is filed for reference in the Department of State.

INDEX TO ADVANCE SHEETS OF CONSULAR REPORTS.

No. 520. September 5.—Cinchona Bark and Quinine in Java—Petroleum in Dutch India—*Tinware in South Africa—*New Ports Opened in Java.

No. 521. September 6.—National Debt of China—National Debts—*Motor Vehicles in Shanghai—Proposed Steamship Line for Argentina.

No. 522. September 7.—Kid Gloves and Kid Skins—Russian Taxes on Trade and Commercial Travelers—Brazilian Tax on Letters Rogatory.

No. 523. September 8.—Pawnbroking in Germany—*Samples of United States Goods Wanted in Syria.

No. 524. September 9.—Work on Siberian Railway—*American Agricultural Implements in New South Wales—*Work on Guayaquil Railway.

The Reports marked with an asterisk (*) will be published in the SCIENTIFIC AMERICAN SUPPLEMENT. Interested parties can obtain the other Reports by application to Bureau of Foreign Commerce, Department of State, Washington, D. C., and we suggest immediate application before the supply is exhausted.

SELECTED FORMULÆ.

Kid Glove Cleaner.—The following will probably answer the purpose as well as anything else:

White castile soap, old and dry	15 parts.
Water (rain or distilled)	15 "
Solution of chlorinated soda	16 "
Ammonia water	1 "

Cut or shave up the soap, add the water, and heat on the water bath to a smooth paste. Remove, let cool, and add the other ingredients and mix thoroughly. To use, apply a little to the glove on a piece of clean flannel. It is said that stains may be removed even from the most delicately colored kid gloves by suspending them for a day in an atmosphere of ammonia. Provide a tall glass cylinder, in the bottom of which place strong aqua ammonia. Be careful to remove from the sides of the jars any ammonia which may be spattered upon them. Suspend the gloves to the stopper in the jar. They must not come in contact with the liquid.—National Druggist.

Paper for Wrapping Silverware.—Make a solution of six parts of sodium hydrate in sufficient water to make it show about 20° B. (s. g. 1·60). To it add four parts zinc oxide, and boil together until the latter is dissolved. Now add sufficient water to reduce the specific gravity of the solution to 1·075 (10° B.) The bath is now ready for use. Dip each sheet in separately, and hang on threads stretched across the room, to dry. Be on your guard against dust, as particles of sand adhering to the paper will scratch the ware wrapped in it. Ware, either plated or silver, wrapped in this paper, will not blacken even in a St. Louis atmosphere, where we have a good deal more hydrogen sulphide in the air than our share.—National Druggist.

Moth Powder.—

Naphthaline	3,000
Camphor	1,000
Cumarine	2
Nitro-benzole	10
Oleum florum naphæ	1

—Neueste Erfindungen und Erfahrungen.

Gloss Starch.—

Boracic acid	15 kilos.
Borax	9 "
Stearine	3 "
White beeswax	3 "

Boil with the adequate quantity of soda lye of 20° Bé. until a liquid mass of unform consistency is obtained, and dry.

The product thus obtained is now mixed with the finest rice starch, in the ratio of 1 to 10, whereby gloss starch is produced, which imparts to the linen, etc., a very fine luster and great stiffness.—Neueste Erfindungen und Erfahrungen.

Repolishing Old Furniture.—Make a paste to fill cracks as follows:

Whiting, plaster of Paris, pumice stone, litharge (equal parts), Japan drier, boiled linseed oil, turpentine, coloring matter, of each a sufficient quantity.

Rub the solids intimately with a mixture of 1 part of the Japan, 2 parts of the linseed oil, and 3 parts of turpentine, coloring to suit with Vandyke brown or sienna.

Lay the filling on with a brush, let it set for about twenty minutes, and then rub off clean except where it is to remain. In two or three days it will be hard enough to polish.

After the surface has been thus prepared, the application of a coat of first-class copal varnish is in order. It is recommended that the varnish be applied in a moderately warm room, as it is injured by becoming chilled in drying. To get the best results in varnishing, some skill and experience is required. The varnish must be kept in an evenly warm temperature, and put on neither too plentifully nor too gingerly.

After a satisfactory smooth and regular surface has been obtained, the polishing proper may be done. This may be accomplished by manual labor and dexterity, or consist in the application of a very thin, even coat of a very fine transparent varnish.

If the hand-polishing method be preferred, it may be pursued by rubbing briskly and thoroughly with the following finishing polish:

Alcohol	8 ounces.
Shellac	2 drachms.
Gum benzoin	2 "
Best poppy oil	2 "

Dissolve the shellac and gum in the alcohol in a warm place, with frequent agitation, and, when cold, add the poppy oil.

This may be applied on the end of a cylindrical rubber made by tightly rolling a piece of flannel which has been torn, not cut, into strips four to six inches wide.

It should be borne in mind that the surface of the cabinet work of a piano is generally veneered, and this being so, necessitates the exercise of much skill and caution in polishing.

Tinning Brass.—Small articles of brass like hooks and eyes may be covered with a thin coating of tin by any of the following methods:

1. Make a saturated solution of cream of tartar in boiling water; place the articles to be coated between sheets of tin, immerse in the liquid, and boil until a sufficient deposit has been obtained. The brass should be freshly cleansed by immersion in dilute acid and subsequent washing or otherwise, just before being submitted to the tinning operation. The articles after being coated are washed in water and brightened by being shaken with bran.

2. Boil peroxide of tin with a strong, aqueous caustic potash solution, until the liquid is saturated with tin, and immerse the articles in this solution.

3. Roseleur recommends the following method: Prepare a solution of—

	Parts.
Chloride of tin in crystals	6
Pyrophosphate of sodium	60
Distilled water	3,000

Place the articles on perforated zinc trays, immerse in the solution, and boil, stirring the contents occasionally to change the points of contact.

The zinc trays are to be scraped clean after each operation to insure perfect contact in the next.—Druggists' Circular.

MISCELLANEOUS NOTES.

What is claimed to be the first adoption of the dustless roadbed process in the West is the use of the same on the Chicago, Burlington and Quincy Railway. Experiments with this process have been made on the Wyoming division of the road with such satisfactory results that arrangements are being made to continue the work elsewhere on the system. Two cars have been arranged for sprinkling the roadbed, and the oil will be sprinkled over the track and for about 5 feet outside each rail.

Wire should not be coiled and uncoiled like hemp rope. It should be mounted on a reel and rolled on or off as required. When a new rope is received from the manufacturers it is coiled up, but not on a roll. The best way to put it in place is to take the coil to a distance from the shaft equal to its length and releasing one end roll it along the ground like a wheel until it is entirely unrolled, when the end nearest the shaft may be passed over the sheaves and onto the hoisting roll and wound up.

In connection with the Elbe-Trave canal which is now approaching completion, the old Hansa town of Lübeck has seen the necessity of regularizing the lower course of the Trave on which Lübeck is situated. It is a winding river which as yet offers a depth of 18 feet only. That depth is to be increased to almost 25 feet, and in the Lübeck harbor to 26 feet. The width will also be enlarged to 460 feet. The town is going to spend £1,250,000 on these improvements. Moles will have to be built at the mouth of the river, where sand banks are inclined to form.

According to Weber, in an interesting paper on the Cellulose Industry, it has been found possible to spin cellulose xanthate or "viscose," the product of the well known reaction between alkali-cellulose and carbon-bisulphide, discovered by Cross and Devan, and to regenerate in a simple manner a cellulose thread possessing an exceeding high silk luster. This viscose silk can be manufactured at a fraction of the cost of Chardonnet silk, over which it has the great advantage of being non-explosive and quite indifferent to water and alkali. Great expectations are being held as to the future of the new fabric produced in this manner.

In a paper contributed to "The Transactions of the British Institute of Preventive Medicine" it is stated that, even in a suburb, the dust particles number some 20,000 per cubic centimeter in the open air and 44,000 in a quiet room; while in the city the totals per cubic centimeter were 500,000 when taken from a roof, 300,000 in a court, and about 400,000 in a room; in other words, the air of the square mile is 900 per cent. thicker than in the suburbs, which is in accord with the general experience that fogs are both more dense and more frequent over the center than in the outskirts. But what is especially interesting in this remarkable paper is the statement that, though dust is the great carrier of micro-organisms, there is only one of these per 38,000,000 of dust atoms. This being so, it is calculated that a man could live in the metropolis for seventy years and only absorb some 25,000,000 of microbes into his system from the air, or about the same number as he drinks in half a pint of unboiled milk.

It would appear that the great Manchester (England) Canal has some disadvantages. While at its vast and splendid docks may be seen the fulfillment of its purpose in extending the facilities of foreign commerce with that city—steamships now being seen there from Russia, Halifax, India, Sweden, London, Italy, and elsewhere—an unfortunate defect is the discoloration of the water and an accompanying offensive odor, well nigh intolerable, caused at times by the refuse and offal from dye and chemical establishments coming down from the upper or river end. Attempts have been made to prevent this unsanitary condition of things, but thus far without avail, as by ancient right the mills continue to use the narrow river for sewage purposes. There has for some time past, however, been a stupendous scheme on foot for a sewage system which is to carry away to the sea Manchester's refuse. It is found that the great dredgers, now at work day and night, can do but comparatively little against such contamination, and, above all, the sanitary requirements of the city imperatively call for action.

The renovation of old lawns is work that requires as much care as making new ones. As a rule, people do not realize the fact that lawns cannot go on forever without some kind of cultivation. A lawn generally has nothing done to it. Grass is continually and year after year being cut from it, and nothing is added to the soil; not even are leaves allowed to remain on and enrich it. Consequently it in time becomes impoverished, moss, lichens, and weeds take the place of grass, and it generally has a bad appearance. In the worst cases it is far better to take up the turf, trench the ground, and relay with new turf or sow with seed. Often a satisfactory remedy for moss is raking so as to get out as much of the moss as possible, and then dress the lawn with a mixture of fine soil, wood ashes, and artificial manure, so as to encourage the growth of grass left, and in bare parts to sow with seed in spring. Often lawns are overrun with coarse brown weeds such as plantain, dandelion, daisy, crowfoot, and sorrel. Where these are not spread thickly, there is no more satisfactory plan than hand weeding. Some use vitriol, but this often kills the grass as well as the weeds, and, so far as my experience goes, the so-called weed killers and lawn savers are not satisfactory. Where weeds are in the grass and are not too thick, it is often the best and cheapest plan to lift the turf, dig up and enrich the surface, and relay the same turf after picking out the weeds from the sods, which can be easily done when the turf-cutter has severed the tap roots. This treatment often is best for a mossy lawn which is primarily due to defective drainage. As I have said before, the weeds on lawns are due to unclean turf at the outset, as they seldom give trouble on sown lawns if due care is taken in weeding the first season before the grass becomes matted. Every old lawn should have some sort of dressing every second or third season at least, and there is nothing better than some of the artificial manures mixed with soil that has no ends of weeds in it. Farmyard manure is the worst dressing, as it invariably contains innumerable seeds of coarse weeds and grasses that are only waiting for favorable conditions to germinate.—Gardeners' Magazine.

TRADE NOTES AND RECEIPTS.

Blue Drawing Paper.—The blue drawing paper of commerce, which is frequently employed for technical drawings, is usually little durable. For the production of a very serviceable and strong drawing paper, the following process is recommended. Mix a solution of—

Gum arabic	2 c. cm.
Ammonia iron citrate	3 "
Tartaric acid	2 "
Distilled water	20 "

After still adding 4 c. cm. of solution of ammonia with a solution of—

Potassium ferricyanide	2·5 c. cm.
Distilled water	10·0 "

and allow the mixture to stand in the dark half an hour. Apply the preparation on the paper by means of a soft brush, in artificial light, and dry in the dark. Next, expose the paper to light until it appears dark violet, place in water for ten seconds, air a short time, wash with water, and finally dip in a solution of—

Eau de javelle	50 c. cm.
Distilled water	1000 "

until it turns dark blue.—Apotheker Zeitung.

Salt Water for Burns.—Any one who has to work near a fire is liable to contract, despite the best of caution, not only a small burn, but even larger wounds of that kind. A very efficacious remedy, according to Dampf, a German class paper, has been found to be a solution of cooking salt in water, which is at hand everywhere. It is best to immerse fingers, hands and arms in the solution, which must be tolerably strong. For burns in the face and other parts of the body, salt water poultices are applied.

According to the D. Tapezierer Zeitung, rust spots are removable from linoleum by rubbing with steel chips. Any other stains on linoleum can be removed by the same simple medium.

Rubbing Wax for Linoleum Floors.—Melt yellow beeswax, 5 kilos.; carnauba wax, 10 kilos.; add, while lukewarm, oil of turpentine, 4·5 kilos., and benzine, 40 kilos., stirring diligently, and fill in tin cans.—Seifensieder Zeitung.

Repairing Rubber Pads and Covers.—Rubber goods, wherever cracks are appearing, may be successfully mended in the following manner:

Before the patching, the cracked surfaces to unite well must be dried, entirely freed from all dirt and dust and greased well, otherwise the surfaces will not combine.

In case of a cover, water-proof coat, or rubber boots, etc., take a moderately thick piece of India rubber, suited to size of the object, cut off the edges obliquely with a sharp knife moistened in water, coat the defective places as well as the cut pieces of rubber with oil of turpentine, lay the coated parts together and subject them for 24 hours to a moderate pressure.

The mended portions will be just as water-proof as the whole one.

Rubber cushions or articles containing air are repaired in a very simple manner, after being cleaned as aforesaid. Then take colophony, dissolve it in alcohol (90°) so that a thick paste forms, smear up the holes, allow all to harden well, and the rubber article, pillow, ball, knee caps, etc., may be used again.—Neueste Erfindungen und Erfahrungen.

Preservation and Use of Calcium Carbide.—Calcium carbide is readily attacked by the air and the moisture contained in the generators and consequently decomposes during the storing, with formation of acetylene gas. Aside from the loss, this decomposition is also attended with dangers. To meet both disadvantages great efforts have been made by the manufacturers and consumers of carbide. One of the oldest propositions is the saturation of the carbide with petroleum, which has been tried in the Elektrochemische Werke at Bitterfeld. In using such carbide a layer of petroleum forms on the surface of the water in the generator, which prevents the water from evaporating, thus limiting the subsequent generation of acetylene from the remaining carbide. Instead of petroleum many other substances were proposed which answer the purpose equally well, e. g., toluol, oils, solid bodies, which previously have to be liquefied, such as stearine, paraffine, resin, etc.

Of a different nature is a medium offered by Létang of Paris. He employs sugar or saccharine bodies to which he adds, if necessary, a little petroleum, turpentine, vaseline or varnish of any kind, as well as chalk, limestone, talc, sulphur, or sand. With this mixture the carbide is coated. The saccharine substances dissolve in the generating water, and also have a dissolving action on the lime-mud which is formed by the decomposition of the carbide which admits of its easy removal. According to another process carbide is put on the market in such a shape that without weighing, merely by counting or measuring one is in a position to use equivalent quantities for every charge. Gearing casts molten carbide in the shape of bars, and pours a layer of gelatine, glue, and water soluble varnish over the carbide bars. Others make shells containing a certain quantity of reduced carbide. For this the following materials may be used. Ordinary and varnished pasteboard wax paper, tinfoil, thin sheet zinc, and similar substances which ward off atmospheric moisture, thus protecting the carbide from premature decomposition. Before use, the cartridge-like shell is pierced or cut open, so that the water can get at the contents. The more or less reduced carbide is filled in the shell either without any admixture or united into a compact mass by a binding agent, such as colophony pitch, tar, sand, etc.—Die Werkstatt.

A new blotting paper, which admits of completely removing from the paper wet as well as dry ink spots, after moistening with water, is produced as follows: Dissolve 100 parts of oxalic acid in 400 parts of alcohol, and immerse porous white paper in this solution until it is completely saturated with it. Next hang the sheets up, separately, to dry over threads. Such paper affords great advantages, but in its characteristic application is serviceable for ferric inks only, while aniline ink spots cannot be removed with it, after drying.—Technische Notizen.

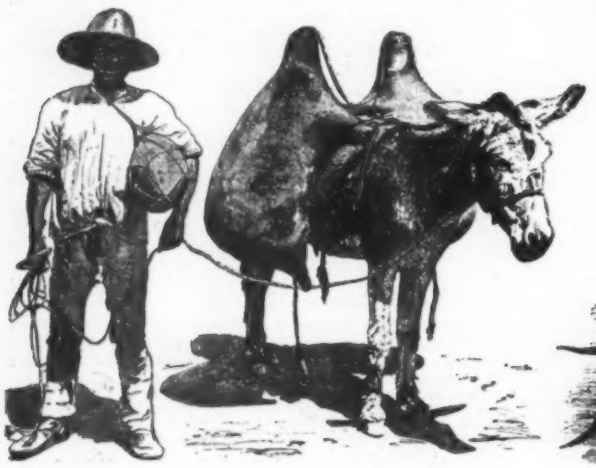
PULQUE—MEXICO'S NATIONAL DRINK.

PULQUE is the most characteristic vegetable product of Mexico. Nothing attracts the attention of the tourist to a greater degree than the huge maguey plantations in the valleys of Apam and Cholula. Here the maguey plant, a species of Agave, is cultivated for its sap; and from these maguey plantations most of the pulque is obtained that is drunk in Mexico. So extensive is the industry that often a single agave plantation will cover over one hundred acres of land. The growing of maguey requires no other labor on the part of the planter than drawing off the sap and removing the withered plant. It is unnecessary to plant new magueys, for, as soon as the old stem has been cut off, new sprouts begin to make their appearance. The species of maguey used for making pulque often attains a height of 10 feet and a diameter of 12 feet. When between the seventh and twelfth years the plant has reached maturity, the leaves thenceforth appearing become smaller, until finally the leaves cease to sprout. The plant then puts forth flowers, the stems of which, if their growth were not arrested, would reach a height of 20 feet. The planter cares nothing for the ornamental value of the maguey, nor for its flowers. As soon as the first bud appears, its heart is cut out. In the hollow thus formed the sap of the plant, which otherwise would nourish the blossom, is collected. A leaf of the plant is then stripped of its green skin, slit open, and slipped over another leaf, as a sign to the flachiquero that he must stop here and collect the sap. The white fibers of the peeled leaf can be seen gleaming in the sun for a great distance, and the flachiquero without loss of time can proceed from plant to plant, carrying on his back the hog's skin containing sap already collected, and in his hand a long-necked, pumpkin-like vessel, having two openings. The flachiquero forces the smaller opening of this vessel into the hollowed core of the bud or flower and sucks out the air until the atmospheric pressure forces the sap into the vessel. The sap thus obtained is poured into the hog's skin.

A single plant will yield altogether 120 gallons in the space of two or three months. During this period the sap must be collected two or three times a day. The skin which forms over the wounded portion of the bud is from time to time removed so that the sap can flow without hindrance.

When the flower has been completely exhausted, the plant dries up. The thick leaves are then removed and used in making brushes, paper, mats, and the like.

The sap which has been gathered by the flachiquero is allowed to ferment for twenty-four hours, and is thereby converted into pulque.



CARRYING PULQUE TO MARKET.

FLACHIQUERO COLLECTING THE SAP OF A MAGUEY-PLANT.

Pulque resembles buttermilk in appearance, but is of greater consistency. It is slightly sour to the taste, and intoxicating in its effect. It is not without its good qualities; for it is an excellent remedy for stomach and liver complaints.

Pulque, after fermentation, can be kept only twenty-four hours; after that period it can no longer be drunk. The proprietors of the pulqueries in the city of Mexico are hence required each morning to empty the casks containing pulque left over from the previous day. The casks are then washed with hot water and refilled.

A glass of pulque costs only one cent; a whole bottle, three cents. Pulque is the Mexican's nectar; without it, he would be unhappy. By distilling the root of a smaller species of maguey, mescal-aloe brandy, a strongly intoxicating drink, is obtained.—Illustrirte Welt.

TRADE WITH OUR POSSESSIONS AND CUBA.

EXPORTS from the United States to Cuba, Porto Rico, Hawaii, and the Philippines were, according to a statement just prepared by the Treasury Bureau of Statistics, larger in the fiscal year just ended than in any preceding year in the history of our commerce with those islands. Even the reciprocity years, 1892, 1893, and 1894, in which the exports from the United States to Cuba and Porto Rico were greatly increased, do not show as large a grand total as does 1899 with all of the disadvantages of war conditions which prevailed in Cuba, Porto Rico, and the Philippines during a part of the year. To Cuba, the total export for the year does not reach the large figures of the two full fiscal years 1893 and 1894 in which the reciprocity treaty with Spain was in operation, and to Porto Rico the total export of 1899 was slightly less than that of 1892, during three-fourths of which the reciprocity treaty was in operation, or 1894, in all of which it operated. To Porto Rico the total exports of the fiscal year 1899 are nearly 25 per cent. in excess of the average annual export during the preceding decade; to Cuba, they are nearly 50 per cent. greater than the average during the preceding decade. To Hawaii they are more than twice as much, and to the Philippines more than three times as much as the average annual exports during the preceding decade. These figures, it is proper to add, do not include the exportations to the islands in question by the government either for use of its troops or in aid of the temporarily destitute.

While the total imports into the United States from these islands are not as large as in earlier years of the decade, this is due solely to the fact that they did not have the supplies for exportation, this being especially true of Cuba, whose sugar plantations and works were so largely destroyed during the war with Spain. That our imports from these islands are rapidly increasing, however, is shown by the fact that those from Cuba in

A MEXICAN PULQUERIA.

the year 1899 were 66 per cent. greater than in 1898; those from Porto Rico, nearly 50 per cent. greater than those of the fiscal year 1898; and those from the Philippines nearly 20 per cent. in excess of those of last year; while those from Hawaii show a slight gain over last year and an increase of 30 per cent. over the fiscal year 1897.

ARCHÆOLOGICAL DISCOVERIES AT CARTHAGE.—II.

HAVING in a preceding article given a resumé of the results of the excavations made in the sanctuary of Jupiter Ammon, it remains for us to speak briefly of the Punic Necropolis discovered far beneath the vault that dates back to the Roman epoch.

FIG. 1.—BULL VOTIVE TO SATURN FOUND IN THE SANCTUARY OF JUPITER AMMON.

Height, 14 inches; carved from grayish-white marble.

The Punic tombs are very ancient, and take us back from the first to the sixth century before our era. These fields of rest in which Carthage buried her dead were respected as long as she remained independent. They widen out in proportion as they are more distant from the center of the city, and the tombs most remote from the latter date from about the third century of our era. The most ancient tombs, on the contrary, are nearest the habitations of primitive Carthage. The vaults are excavated in the solid rock in the plateau of tufa that extends beyond Bordj-Djedid.

The first tombs opened by M. Gauckler were simple burial trenches excavated in the sand. They were generally poor and contained only the scarabæus of carnelian and paste; a sort of card of identification of the cadaver; a bronze ring, an ostrich egg disk, a painted figure serving as a protective amulet; and a few pieces of pottery, but never any money. Other trenches were covered with a simple stone slab. In one of these was found a large intact Punic mask of terra cotta very similar to one of the pieces of the same kind found by Father Delattre. To the features of the face was given a hideous grin, so as to frighten off the sacrilegious who might attempt to violate the sepulcher.

Another tomb contained an Assyrian cylinder of jade, representing the god Marduck strangling a winged monster. In measure as an advance was made toward the hill, the tombs became more compact, as well as richer. Some were arranged like troughs and were entirely lined with slabs of stone. In these were found silver jewelry; collars, numerous pearls of glass paste; some hard stones, such as carnelian, amethysts, agate and rock crystal; and earrings and a few gold finger rings.

During last February, M. Gauckler discovered two large tombs constructed like that of Iadamelek, which was found in 1894 at the same depth of 23 feet. The funereal chamber was closed by a monolith door. The flat roof was protected against the earth by a series of monoliths forming a shelving ridge, and the interior of the roof was ceiled with cedar which was crumbling away, and the debris of which fell into dust under the pressure of the finger. The walls were covered with stucco of dazzling whiteness. At the back of the chamber there was a small broken water jug. In the first tomb the niche was vacant, while in the second it was occupied by two pieces of pottery.

The skeleton was stretched out directly upon the floor without any coffin and was bedecked with jewelry. In one corner there was quite a number of jars of large size.

The first tomb contained two skeletons, those of a husband and wife. On his finger, the man wore a silver ring with a carnelian scarabæus and a seal. The woman wore ear-rings, a collar pendant, and a ring provided with a stone representing a ringed uræus and two doves. All these were of massive gold.

The second tomb contained nothing but the body of a man with a space formed alongside of it. All that was found were a single silver ring with a scarabæus of glass paste; two gold cylinders; a cantharis and a cup and some pieces of pottery. These two tombs were, upon the whole, not so rich as might have been expected, seeing the care that had been lavished in their construction.

Right alongside, there was found a third tomb, which was much more simple and constructed between the preceding. In this there was no ceiling, no cedar, no pottery, no stucco, and no niche, but as an offset, some funereal furnishings of unheard of richness. Here lay a woman, perhaps a priestess, holding in her left hand a large bronze mirror, and, in her right, heavy cymbals of the same metal. The left wrist disappeared under a bracelet of pearls, scarabæi and small figures. On the right arm there were several rings of silver and ivory. The fingers were loaded with silver rings and a gold ring with four cynocephali engraved upon the setting. In the left ear there was a gold pendant with the cross of "tau." On the neck there was a large collar of massive gold formed of forty elements of various shapes arranged symmetrically on one side and another of a central brooch representing a crescent of turquoise falling upon a disk of hyacinth. But this is not all; for there must be added another collar, this time of silver; an arybalis; a Corinthian alabaster with figures; a large enamel bottle covered with gold leaf; a statuette of multi-colored faience, of Egyptian style; some painted ostrich egg disks; some shells filled with purple paint; some pieces of pottery, and a lamp.

All these objects discovered by the eminent archæologist are, with the exception of the duplicates, to be sent to the Bardo Museum.

It is but just, in conclusion, to pay our respects to the enlightened role of M. Cæsar Ben Attar, a lawyer of Tunis. It is in fact due to his persistence and good advice that it has been possible to make these excavations under conditions advantageous to the state.

In the presence of the magnificent results obtained, it is impossible to restrain a feeling of gratitude for M. Gauckler, and of admiration for the bringing to light of so many treasures. These excavations pursued in the ancient necropolis of Carthage reveal to us a civilization that was strange and refined but all permeated with Asiatic or Egyptian elements, and that had undergone only to a feeble degree the influence of the western peoples with which it came into contact. It is indeed Phœnician Carthage with all the savor of its primitive originality, very different from the city of the Punic wars, but already transformed by Italo-Greek civilization.

For the above particulars and the engravings we are indebted to La Nature.

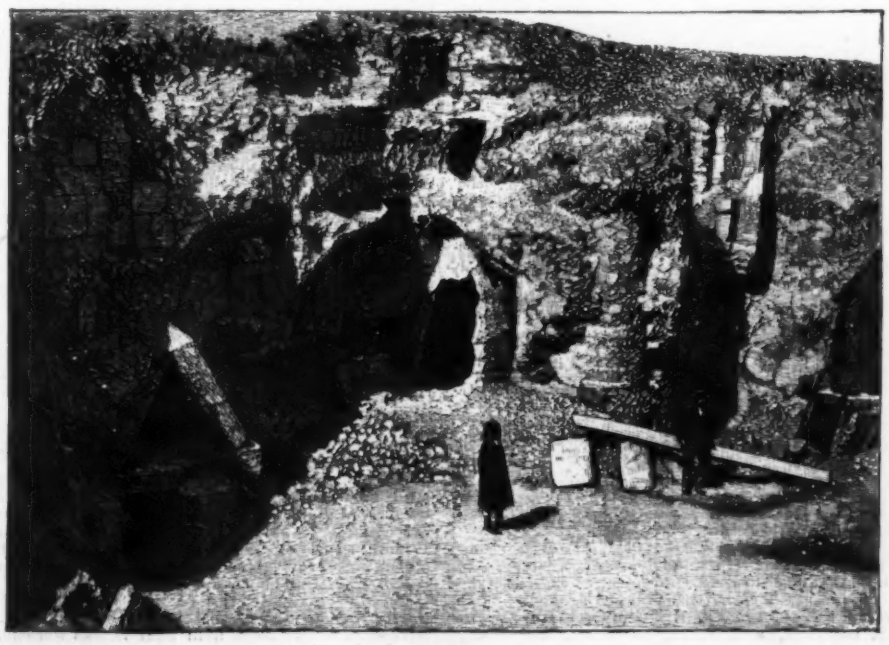


FIG. 2.—VIEW OF THE PLACE OF EXCAVATIONS, TAKEN IN APRIL, 1899.

Roman structures and cisterns; tombs and great Punic funereal vaults of the seventh century B. C.

EGYPTIAN PAPYRI.

THE trustees of the British Museum have issued a volume of selected papyri containing facsimiles and translations of five of the finest documents in the Egyptian collection. Four of these belong to the Theban period, from the eighteenth to the twenty-first dynasty, and the fifth is a remarkable papyrus of the Ptolemaic age. This last is the form of the funeral service which was drawn up during the time of the Ptolemies, and which represents the religious beliefs of the period when the Book of the Dead was becoming lost, and only an echo of the older ritual survived. The first papyrus is that of Hunefer, who was overseer of the palace and superintendent of the royal cattle in the service of Seti I., about B. C. 1370. The illuminated vignettes are in the highest style of the art of the age in which they were executed, and it contains two hymns —one to Ra and one to Osiris—which are not found in any other papyri, and which are remarkable for their beauty. As an example, we may quote the following from the former of these compositions, that addressed to the sun god: "Men adore thee in thy name of Ra, and they swear by thee, for thou art lord over them, and thou hearest with thine ears and seest with thine eyes; thou dost journey over untold spaces of millions and of hundreds and thousands of years; thou sailest over them in peace, and thou steerest thy way over the watery abyss to the place which thou lovest. This thou doest in one little moment of time; then thou dost sink down, and dost make an end of the hours." The papyrus is also interesting as containing a very full account of the ceremonies which took place at the tomb on the day of the funeral, and of which very fine drawings are given. It is curious to see the priest preceding the boat or ark on which the mummy is laid, with a censor of incense in one hand and a vase of water with which he is sprinkling the body in the other; while a second priest, wearing a white robe, walks behind reading the funeral service.

The second papyrus in this new collection is that of Anhai, a lady member of the Theban College of Amen-Ra, who lived about 1100 B. C. It differs from all previous copies of the Book of the Dead, as the vignettes which illustrate it are taken from a work called "The Book of Knowing that which is in the Underworld." It is also remarkable because it contains a scene representing the creation of the world, which occurs elsewhere only upon the sarcophagus of Seti I. in the Sloane Museum.

The third papyrus is of especial interest, inasmuch as it is the funeral ritual of Queen Netchemet. This lady seems to have been the wife of the priest-king Her-heru-sa-Amen of the twenty-first dynasty. Her titles are set forth as "chief great lady of the ladies of the College of Amen-Ra, and royal mother of the Lord of the two lands." It is evident that he who is referred to as the "Lord of the two lands" must be Piankhi, the famous Ethiopian priest-king. The papyrus was found on the occasion of the great discovery at Deir-el-behari, where the mummies of so many Pharaohs and their queens were discovered. It is written in hieratic, and not in hieroglyphics, and contains a number of rare chapters of the Book of the Dead. There is a curious passage in this papyrus regarding the great care

which was to be taken of this special copy of the funeral ritual. "This book," it says, "will make thee to know what things will befall the deceased. This book is indeed a mystery. Let it never be learned by any stranger in any place whatsoever; let no man or woman utter the words thereof. Let no eye whatsoever behold it; let no ears hear it, except those of thy son and of him that taught it unto thee. Thou shalt not put it into the mouths of the multitude, but only into thine own mouth; thou shalt recite it within the chamber of the 'swathings.' This book is indeed a mystery. Suffer no one of the common folk in any place to see it. It shall provide food in the underworld for the deceased; it shall make him to live for ever and ever, and no evil thing shall gain the mastery over him."

Fourth in order of publication comes a papyrus which is a most remarkable document. It is small—only 6 feet 10 inches in length—and it belongs to the Roman or Ptolemaic age. The work was compiled by a certain person named Kerasher, whose official position, however, is not indicated in the document. The full title of the papyrus is the "Book of Breathings," and it belongs to a series of late funeral rituals, such as the Lamentations of Isis and Nepthys, which were published a few years ago by Dr. Budge. The ideas and beliefs expressed in it are not new; indeed, every one of them may be found repeated in the religious works of the ancient Egyptians. It seems as if the old Book of the Dead had in the latest times become unacceptable to the Egyptians who lived under the Greek and Roman rule. Besides, it is tolerably certain that very few persons then understood it. The "Book of Breathings" consists of a series of disjointed fragments. We have, for example, a portion of the "negative" confession, but there is no judgment scene, while the eschatology of the book suggests the existence of belief in the resurrection of the body and of a life in the world beyond the grave, not unlike that passed upon earth. This book abounds in peculiarities which are of great interest. The following extract shows its composition to be drawn from more than one school of theology: "The odors or breaths of the holy Persea tree which is in Heliopolis are wafted unto thee; thou wakest each day and lookest on the beams of the god Ra. The god Amen cometh unto thee bearing the breath of life. He causeth thee to breathe it in thy funeral chest. Thou comest forth upon earth, and Thoth's Book of Breathings is a protection for thee, because thereby thou dost breathe each day, and through thine eyes lookest upon the beams of the disk." Here we have matter from the school of On or Heliopolis, from the Theban school of Amen-Ra, from the scribal school of Thoth, and possibly a reference to the "heretic" disk-worship. The book evidently shows that the belief at this period was that of a resurrection of the material body and the return to earth. Thus we read: "Let him live upon earth for ever and ever, and ever and ever." And again: "Thou revivest thy form upon earth with life." The work is interesting, as there are many passages which have very curious resemblances to the Christian beliefs in the resurrection, and also to the teachings of Egyptian apocryphal literature.

The last papyrus in this new issue is one of the recent additions to the museum. It is that written for a great official who lived during the eighteenth dynasty, i. e., about 1650 B. C., and probably during the reign of one of the Amen-heteps. His name was Nu, and he was a son of the overseer of the house of the chancellor or keeper of the seal, an office which his father, Amen-hetep, held before him. The document was written for Nu and his wife (who is called "the lady of the house"), named Sen-Senep. The papyrus itself, which was found at Qurna, near Thebes, was purchased by the trustees of the British Museum in 1891, and measures 65 feet in length and 1 foot 1¼ inches in breadth. The material is the finest Theban papyrus. The text is the most complete and carefully written version of the "Book of the Dead," as it contains 131 chapters, of which fifteen are accompanied by vignettes. These illustrations are apparently the work of an artist, and not of the scribe, who in all probability was Nu himself. It is most carefully written and contains many valuable variants. It is the earliest known of the Theban papyri, and, consequently, of great importance for the reconstruction of the text. It is curious to notice that it has no introductory hymns, as in the case of the papyrus of Am, nor does it contain the judgment scene. The text is here given in full, and many of the chapters have been translated by Dr. Budge in his recently published version of the "Book of the Dead."

Not only are these papyri just published of great value for their literary contents, but we have some most magnificent artistic work. The papyri of Hunefer is certainly the finest piece of artistic work of the Theban school. The colors are brilliant and as fresh as the day they were painted. The scene of the funeral ceremonial is particularly valuable, more so, perhaps, than even that of Ani, inasmuch as it represents a scene which no doubt took place at the door of the tomb. We have also here, what is unusual, a drawing of the funeral stele, which is placed at the entrance of the tomb, and would seem to have been prepared ready for the funeral. In the papyrus of the singer of Amen, Anhai (referred to above), the drawing, especially the portraits of the priestess herself, exhibits very fine delineation, although the coloring is not so good. The papyrus of Queen Netchemet is not of such great value as a work of art, but it contains a number of scenes hitherto unknown. The scenes in the "Book of Breathings" are very badly drawn, and, like the text, full of confusion. The funeral scene as here depicted would seem almost to be a caricature of that in the Theban papyri.—The Architect and Contract Reporter.

OUTLINE HISTORY OF BRICK MAKING.

THE manufacture of brick is at least forty-one centuries old. The first brickmakers we have record of were those people who built the Tower of Babel on the plains of Shinar, 2247 B. C. The chief hardships of the servitude of the Israelites in Egypt consisted in the making, carrying, and laying of brick. On many Egyptian monuments there are pictures representing the process whereby the children of Israel prepared this building material for the Pharaoh. Some laborers are shown carrying pots of water to temper the clay; some carrying on their shoulders masses of clay to the molder, and others bearing off the brick to dry. There appear also many of the taskmasters whom the Pharaoh, to increase the burdens and labor of the Israelites, commanded, saying: "Ye shall no more give the people straw to make brick, as heretofore; let them go and gather straw for themselves; and the tale of the bricks, which they did make heretofore, ye shall lay upon them." (Exodus, V.)

The only brick earth in Egypt is the mud of the Nile, and the Egyptian method of brick making is to-day the same as it was in the days of the Pharaohs. A bed is made, and into it are thrown large quantities of mud, water and cut straw. These materials are tramped into pug, removed in lumps, shaped in molds or by the hands, and sun-dried. Although the builders on the plains of Shinar proposed to "make bricks and burn them thoroughly," yet most of the ancient bricks were adobes, or sun-dried bricks. It is a remarkable fact that those descendants of Noah should know the greater durability of well burnt bricks than sun-dried ones, and make so much better application of their knowledge than did the generations that followed for centuries after them. But those primitive folk were well aware that only thoroughly burnt brick can sustain great weight and severe exposure to weather.

Besides the Tower of Babel, the exposed faces of the walls of Babylon were also made of burnt brick. The oldest Greek historian, Herodotus, states that the walls of Babylon were built of bricks made of the clay cast from the surrounding trenches. For a long period of years the buried palaces of Nebuchadnezzar and the great mounds of brick which mark the sites of several ancient cities in the valleys of the Tigris and Euphrates have supplied bricks for all the buildings in the neighborhood. Hillar, a city of 8,000 inhabitants near the ruins of Babylon, is built altogether of these ancient bricks. In fact, these old bricks constitute an important article of local commerce, many men having no other trade than that of gathering them for sale in the neighboring towns and villages, and even in Bagdad. Many of the bricks are coated with a thick enamel or glaze, and their colors, red, yellow and blue, preserve their original brightness. As to the sizes of the Babylonish bricks, the burned ones measured 13 × 13 × 3 inches and the adobes varied from 6 to 16 inches square and from 2 to 7 inches thick. The Babylonians made also triangular bricks for the corners of walls, and wedge shaped bricks for arches, these arch bricks being sometimes concave below and convex above. A striking peculiarity of the Babylonish bricks that are used in the walls of modern Bagdad is that they all bear the name of Nebuchadnezzar, whose custom it was to have his signature stamped on every brick made during his reign.

In ancient Egypt, it is believed, the manufacture of brick was a royal monopoly; for many bricks found there bear the stamped signature of Thothmes III., the reputed Pharaoh of the Exodus of the Hebrews. In Egypt, as in Babylon, most of the bricks used in decoration were colored red, yellow, or blue; though sometimes the colors white, black, and green were added. The adobes made by Thothmes measured 9 × 12 × 6¾ inches.

The Great Wall of China, completed in 211 B. C., was built of both burned and unburned brick, and stone. It was about 1,250 miles long and its average height is about 22 feet. It is broader at the bottom than at the top, which is wide enough for six horsemen to ride abreast. This stupendous structure was erected by Emperor Shee-Hoang-Ti, the national hero of China, as a barrier against the Tartars of the northern steppes, who were then beginning their southward migrations.

In Greece, owing to the abundance and excellence of the stone found there, bricks were used little for building. Probably the largest undertaking in which the Greeks used bricks was the construction of the walls of Athens on the side toward Mount Hymettus. In architectural construction, the use of brick was confined, in Greece, almost wholly to a few public buildings.

The Romans carried the art of brick making to a higher degree of excellence than did the Greeks. Pliny states that Greek bricks were not fit for the construction of a Roman dwelling, as they were so poor that they could not support one story. The Roman bricks of the first century of the Christian era were of a very good quality. Although burned bricks were used by the builders on the plans of Shinar and by the Babylonians, it is probable that the credit of first burning bricks in kilns belongs to the Romans. The latter became acquainted with the arts of Greece, Carthage, and Egypt after their conquest of those countries, and it is likely that they came to use brick kilns in their efforts to improve on those arts. From the boast of Augustus, "I found Rome a city of bricks and have made it a city of marble," one may infer that bricks were much used in ancient Roman building.

The bricks of the first century of the Christian era were better than those of any earlier period. They resembled what are called to-day Roman tiles, but they were used, not only for roofing and paving, but for walls as well. In wall construction, however, the Romans used brick only for facing, and used concrete for the backing of walls. These brick usually measured 2 × 2 × 1 inch. Later on, though, brick became shorter and thicker until, in the fourth century, they were often made about the size and shape of modern building brick. Roman brickwork reached the height of its excellence during the second century A. D. During the third century it showed no improvement, and during the fourth century there was a marked decline.

The Romans made many bricks in Germany and Britain; but after they lost control over these countries, brick making became a lost art therein. There is no evidence that any bricks were made in England between Roman times and the thirteenth century, though in a few instances, as at Colchester and St. Alban's Abbey, bricks were taken from the old Roman town of Verulium and reused. Until the eleventh century, the Anglo-Saxons usually built of wood, with the exception of a few churches, which probably constitute the earliest stone buildings in Western Europe after the time of Roman supremacy. Although it has been held that bricks were made in England during the ninth century, under the direction of Alfred the Great, there is no authentic account of their being used in any building erected during his reign. Perhaps the oldest brick building existing in England is Little Wenham Hall, in Suffolk, erected in A. D. 1260. Under Henry VIII. and Elizabeth brick making flourished in England. Then most of the large buildings were constructed of brick.

Until the year 1625, the bricks made in England varied greatly in size. In that year, however, Charles I. regulated their size and made it almost uniform. After the great fire in London in 1666, brick was generally used for rebuilding that city, and chisel-wrought ornaments were introduced into the brickwork there at that time.

Brick making flourished chiefly, of course, in the lowland countries, stone being the chief building material in mountainous countries like Scotland. In the Netherlands, where stone was scarce, bricks were manufactured and used for building and paving at an early date.

We shall now turn to the history of bricks in the United States. It was under Wouter Van Twiller, of Amsterdam, a governor appointed by the Dutch West India Company, that the first brick buildings were erected in this country. In 1633, soon after his arrival on Manhattan Island, Governor Van Twiller erected for his own use a substantial brick house, which was the most elaborate private dwelling which up to that time had been attempted in America, and during the remainder of the Dutch dynasty this dwelling served for the residence of the successive chiefs of the colony. He also built several small brick dwellings for the officers, which, with his own, were erected within the walls of the fort. The bricks used in these buildings were brought from Amsterdam, and were of such good quality that but few were broken in the long and rough voyage. The Dutch seem to have succeeded well in making a strong and very durable quality of brick, which bricks have been famous from an early period for soundness, and specimens of them brought over by the early settlers from Holland are yet to be met with in some of the old Dutch houses of New York.

Among the Puritan emigrants to New England money was very scarce, and, under Winthrop, carpenters and bricklayers, whose services were in great demand and had a monopoly price, were forbidden to accept over 12 d., and afterward, in 1630, 2 s. per day, the penalty being 10 s. to giver and taker. The bricklayers were also the stone masons, they ranked under the first head; but a much larger amount of building was done in wood and stone than in brick in those times.

The earliest settlement in this country in which brick makers are recorded as being part of the population was the colony of New Haven. In this industrious and inventive little company it is probable that the first bricks made in this country were burned, in 1650. They had no rich backers willing to foot the bills for costly brick buildings, as the Dutch West India Company had done for Governor Van Twiller in his building operations at Manhattan, or New Amsterdam, as it was called at a later period. They had made several attempts to produce bricks at earlier times, but had failed, and it is not probable that the very few that they did succeed in burning were of a very superior quality. But like the building of their ship, which sailed from their ice-bound shore and was never heard of again, though faulty in many respects, their production was an evidence of great energy, and it is the inheritance of this same quality that has made all that section of country a great manufacturing and inventive district.

The Virginia colonists possessed clay of a far superior quality for brick making, but they do not seem to have made any attempt to utilize it. A few bricks were brought from England and were used in the furnaces of an iron foundry and a glass house, both of which were destroyed during the great massacre of March, 1622, and appear to have comprised the entire manufactures of the colony.

Brick has been a choice material for building purposes in the State of Pennsylvania from its primitive days. In a letter from William Penn to his agent, J. Harrison, at Pennsbury, written in 1685, in speaking of a lady who had purchased land and intended to emigrate, he said: "She wants a house of brick, like Hannah Psalter's in Burlington, and she will give 40 pounds sterling in money and as much more in goods. It must have four rooms below, about 36 × 18 feet large, the rooms 9 feet high, and two stories height." Some idea of the great purchasing power of money in those days, as well as the price and value of buildings, can be gained from the foregoing.

In 1705 the price of bricklayers' labor in Philadelphia was 3 shillings and 6 pence per day, and the price of bricks 22 shillings per M. One of the oldest public buildings in this country constructed of brick was the old court house in the city of Philadelphia, commenced in the fall of 1705, and to these pilgrim fathers the erection of this building was a great undertaking and their largest endeavor. Gifts, fines, assessments and forfeitures were all combined to give it the amplitude of a "Great Towne House" or "Guild Hall," as it was sometimes called when first built. To modern ideas this building was small and ignoble; but in those days it was grand and imposing in the eyes of all the populace. The total expense of the structure was 616 pounds, the bricks costing 29 shillings and 6 pence per M, and the bricklaying costing 14 shillings per M. This primitive building was erected in the middle of High, or, as it is now called, Market Street, at the corner of Second, and after being used for various purposes for 130 years, it was demolished in the spring of 1837. For about 28 years it was used as a court house; but its use for that purpose was superseded by the erection of "the new State House," or "Independence Hall," as it is now called, which was built of brick in 1733. Another primitive brick building in that city was the "Great Meeting House," of Friends, at the south of the "Great Towne House," on the corner of Second and High Streets. This building and the surrounding brick walls which inclosed it were erected in 1695, the ground being given for that purpose by George Fox, for "truth's and Friends' sake." Early in 1719 bricks came into use for foot pavements in Philadelphia, and the great demand for them made the material very expensive.

Bricks do not appear to have been much used in the early buildings of Boston, as wood seems to have been the favorite material for building purposes with the Puritan emigrants, stone being sometimes employed. The first "Towne House" erected in Boston was constructed of wood; it was built about 1657, and stood at the head of State Street, and was consumed in the great fire of 1711. Its successor was a brick edifice,

erected in 1712 on the same spot, which in turn was destroyed by fire in 1747. The old State House was built the next near, 1748, and as late as 1791 it was described as "an elegant brick building, 110 feet in length and 38 in breadth." The first Episcopal church in Boston was erected in 1689, of wood, at a cost of 294 pounds, and was at the corner of Tremont and School Streets. The "Triangular Warehouse," which stood at the head of the "towne dock," was one of the earliest brick buildings erected in Boston; it was built by London merchants about 1700; its foundation was of stone and its walls of brick, which were of a larger size than the bricks of the country in later times.

Brickwork became common in this country in the early part of the eighteenth century, and until the trouble between the colonies and the mother country, bricks were imported mostly from England.

There was not much inducement to produce home-made bricks previous to this time, as vessels sailing with light cargoes for the colonies would finish out with bricks, which commanded ready sales, at moderate prices, rather than with stone ballast, which would have to be thrown overboard before receiving their heavy return cargoes of tobacco and other exports of the colonies.

In this way a number of brick buildings were constructed on the tide waters of the Atlantic coast, in the times which preceded the troublesome period of the revolution.

At the period immediately following this war, there was but little done in the line of building; the generally distressed condition of the industries and the finances of the country was a bar to any improvements, excepting such as were in the nature of repairs, and necessary to make buildings inhabitable. The condition of things, after the adoption of the constitution, gradually changed; churches, and other buildings of a public character, which had remained in an unfinished state during the war, were completed, and a few houses of a substantial character were erected in some portions of the country, home-made bricks being employed when they could be obtained and the character of the buildings admitted, which was but seldom, as wood and stone entered largely into the construction of the great proportion of all buildings. The inventive genius of the new nation was not much stimulated to improve on the manner of the mother country in the production of bricks. In fact, those which we then made were poorly moulded and burned, and compared unfavorably with the common bricks of English and Dutch manufacture.

But at the present time, for both quantity and quality, we have no equal in any nation of the world, and for this we are largely indebted to the American patent system, which greatly fosters and encourages development in this line, as in other and kindred arts.

The American machines for the production of bricks are fruits of the patent system, and they are evidences of a high civilization, and but tokens of what will in time place the manufactures of the world under our control.

During the years from 1790 to 1812 inventors confined themselves almost wholly to agricultural and commercial objects. Implements for tilling the soil and converting its products and machinery for navigation attracted most attention. Manufactures, except those of a purely domestic character for domestic purposes, were hardly known; the arts were poorly understood and little cultivated. The necessities of the New World drove its enterprise into other channels, and its people looked to Europe for manufactured products not directly connected with the necessities of life or demanded by the development of its commerce and agriculture. But the war of 1812 forced our people to attempt production in many branches of manufacture and industry heretofore almost wholly uncultivated.

Improvements in modes or machines for manufacturing common bricks received but little attention until about 1840; previously they were more remarkable for uniqueness in some special point of but small importance, than for any generally good achievements. No attention was paid to the character of the brick after it came from the kiln; the whole idea seemed to be to shape or mold it in some manner. For instance, one machine was made like a box now used by plasterers to run off their lime; it was elevated, and the mud, which was mixed in the box, allowed to pass through a grate, a large framework having sides about three inches high and divided by wires stretched lengthwise of it and across it, which lay upon the bottom, and when the clay in the shallow box was somewhat hardened, the wires were raised and the bricks thereby cut and formed into shape. The box, when emptied of the clay, could be easily moved on wheels running on a plank gangway to the next shallow mold-box, and so on. But the slush stock made in this way was very inferior; it would dry unequally, and be full of cracks, and was subjected to no packing, as in the pug-mill; or pressure, as by the machines of to-day; or a blow, as is done by the hand-molder, who dashes the tempered and packed clay into the mold with great force and again forces it down closer together with his hands and plane. When the bricks came from the kiln they were very light, open and porous, and therefore absorbed water readily, and were entirely unfit for building purposes.—Brick.

STORAGE BATTERY PATENTS.

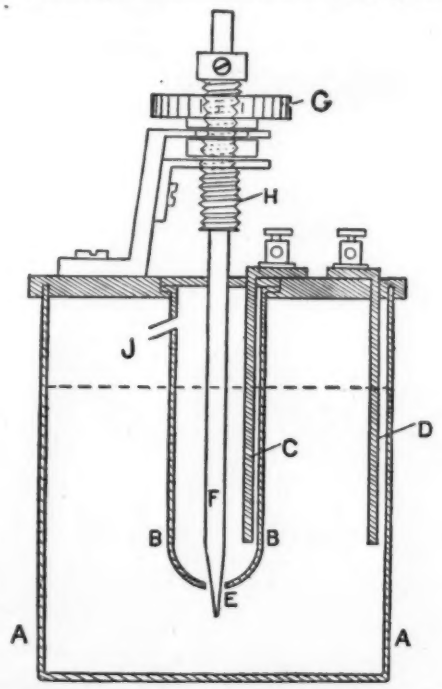
AMONG the patents of March 21 are two on improvements in storage batteries, and a third on a storage battery transfer switch. One of these, issued to P. J. Dujardin, of Paris, relates to storage batteries of the lead-zinc type. In this type of battery the presence of mercury is stated to be indispensable, in order to avoid local action when the circuit is open, and to permit of amalgamation of the layers of zinc added during charge. Several forms of plates are described, but all consist of vertical supports for horizontal conductors of small thickness and suitably spaced vertically. These horizontal portions of the plate may be either of zinc or carbon coated with zinc. One form consists of a number of small zinc wires twisted in the form of a cable, the interstices of which retain by capillary attraction a quantity of mercury sufficient to keep the zinc amalgamated. Other forms of plates are described, in which other means are used for retaining the mercury. A patent granted to A. Schanschieeff and A. E. Hodgson, of Halifax, England, is for a form of plate having strength and rigidity with comparative lightness, and also providing sufficient locking facilities for holding the paste. One of the forms of plate described consists of two perforated lead plates superimposed. In making the perforations the metal at the edges of the holes is caused to project, and when the two plates thus punched are placed with their flat surfaces together and the holes coinciding, the protruding edges of the holes serve to hold the paste between the plates. A patent issued to Charles Hewitt, of Philadelphia, relates to a transfer wattmeter switch for storage battery circuits, the object of which is to provide apparatus for measuring current intermittently supplied to and from a storage battery. A mercury switch is used in connection with two wattmeters and with an electromagnet arrangement such that when the battery is being charged, the current is switched through one meter and on discharge is switched through a second meter.—Electrical World.

AN IMPROVED LIQUID INTERRUPTER FOR INDUCTION COILS.

THE following is a description of an improved form of Wehnelt-Caldwell interrupter for induction coils, devised by the writer in conjunction with Mr. J. C. M. Stanton and Mr. H. Tyson Wolff.

The two electrodes of sheet lead, *C* and *D*, dip into dilute sulphuric acid, contained in the glass vessel, *A*. The electrodes are separated by a hollow glass or porcelain cylinder, *B*, which surrounds the electrode, *C*. This cylinder is closed at the bottom with the exception of a circular aperture, *E*, about three or four millimeters in diameter. Through this aperture projects the small end of the conical glass or porcelain valve, *F*, which by means of the screwed carrier tube, *H*, and the milled nut, *G*, can be raised or lowered so as to open or close the aperture to any desired extent. As when the apparatus is at work the liquid is found to rise in the cylinder, *B*, the latter is provided with an overflow at *J*.

The interruptions take place in the valve aperture,



AN IMPROVED LIQUID INTERRUPTER FOR INDUCTION COILS.

and appear to be due to the formation of gas or steam therein. The extent to which the valve is opened or shut determines the amount of current passed, and the frequency within wide limits. The wider the valve is open the larger is the current and the lower is the frequency, and vice versa. With this apparatus in circuit with a 10-inch coil connected direct to the 100-volt supply mains, it was found that by adjusting the valve the primary current could be altered from 0 to 25 amperes, while the pitch of the sound of the discharge could be changed from a very shrill whistle down to a rattling roar. By introducing additional self-induction into the circuit, the frequency can be lowered still further.

The direction of the current through the apparatus does not affect the results, and the arrangement, when suitably adjusted, works well with alternating current, the sparks in each direction being of equal power. The troublesome fatigue phenomena to which the Wehnelt instrument is liable appear to be absent, while the difficulties as to the fusing of the platinum wire and the cracking of its insulating sheath are also avoided. This improved instrument has in fact all the advantages of that of Caldwell, of which it is a modification, with the further advantage of easy adjustment to suit different voltages and to give different amounts of power and different frequencies.—A. A. Campbell Swinton, in Nature.

LONG DISTANCE TELEPHONY.

THE long distance telephone system now extends to Montreal and other Canadian cities on the north and east; to Minneapolis, St. Paul, and the Dakotas on the northwest; to Omaha, Kansas City, and Little Rock, and nearly all intermediate towns of any size, on the southwest; and to Nashville, Birmingham, Montgomery and Mobile, Ala., on the south. There is still a gap between Mobile and New Orleans, which gap will soon be connected with long distance copper wires.

A writer in The New York Evening Post states that the improvements which have made long distance telephony possible have not been in the instrument at all, but in the line and in the line construction. The first step in extending the possibilities of long distance telephony was to use two wires instead of one. One wire had been employed for many years, the earth being used for the return path. This was, and still is, the practice in telegraphy.

For many years efforts were made to increase the distance of possible talking by increasing the power of the transmitter. It was found that as the single lines increased in length the telephone receiver, which is the most delicate detecter of faint currents known, began to take up inductive noises from the earth itself. When such lines ran parallel with telegraph lines the receiver would take up the Morse signals, so that a telegraph message could be read by an expert operator simply by listening to a receiver attached to a parallel line without tapping the telegraph line at all, and, indeed, without coming into physical contact with it.

It is believed that the first long distance line was built from New York to Philadelphia. This was after it had become known that it was best to eliminate "earths" from the circuit, using two wires all the way instead of one. It was ascertained, however, that even two parallel iron wires soon reached their limit of efficiency, though a limit wider than before, through being unbalanced and taking up inductive disturbances, which were reproduced in the receiver with exasperating fidelity. As soon as telephone engineers found that two wires were better than one, it was but a step to use copper instead of iron, the conductivity of copper being much better than that of iron. It was only an obvious further step to use two large copper wires instead of two small ones, still further extending the limits of possible commercial conversation.

But even this last step did not solve the problem. Make two copper wires as large as one might, a distance would be reached where there would be set up in the receiver inductive disturbance of a character so loud that no transmitter, no matter how powerful, could be efficient against it. The final solution of the problem was almost absurd in its simplicity. This solution is technically known as "transposition." It was found that where two copper lines ran along parallel with each other, say for fifty miles, if at a point half way between the terminals these wires were crossed without touching each other, i. e., so that what had been the right-hand wire for 25 miles would become the left-hand wire for the remaining 25 miles, and the same crossing made with the other wire, the noise would be very much diminished. It was still further found that if instead of crossing or transposing the wires from right to left and left to right at one central point in the circuit, a number of such crosses could be made, say, at a distance of 5 miles or 1 mile apart, the inductive disturbances would disappear entirely, so that even a comparatively poor transmitter would be able to talk over a distance of 500 miles without difficulty.

Calculations were then made as to how large two copper wires would have to be in order efficiently to carry telephone currents from New York, Boston, Philadelphia, etc., to Chicago and beyond. This question, of course, introduced new factors of an unusual nature, from the viewpoint of the electrical engineers, who would like to have the wires as large as possible. What more closely interests the mechanical engineer is the knowledge of the weight of these wires, as he must erect and equip poles strong enough to carry them. From the manager's point of view, an estimate had to be made as to whether the probable traffic over the wires would be more than the interest on the enormous amount of money necessary to construct two copper rods—for these wires are so large that they are really more like rods than wires—from New York to Chicago. It was finally decided to use No. 8 hard-drawn copper wire between New York and Chicago, and since that time No. 8 has become the standard for all the long copper circuits of the Long Distance Company. Where these telephone wires pass through cities in which there are electric lights and heavy electric power circuits, the transposition has to be made oftener than once every mile. In some places it has to be made at every pole. This makes the construction work very expensive, indeed, and toll charges are computed accordingly.—The Iron Age.

UNITED STATES MAIL ON STREET CARS.

AT the recent convention of the American Street Railway Association a paper was read by W. S. Dimmock on "The Carrying of United States Mail on Street Railways."

The paper brought out the extreme importance of the saving of time in the distribution and collection of mail matter, which is undoubtedly the most potent argument in favor of the electric car service. As a general thing interferences and delays with electric mail cars have been found to be fewer than with wagons over the same route. Another great advantage of the electric car transmission is the more frequent service obtainable between post offices, depots, and sub-stations. Before the electrical car service was installed the mails were necessarily carried by wagon from one post office to the railroad, by rail across the river, and by wagon again to the other post office. The number of trips per day was much smaller than desirable, owing to the lack of a sufficiently frequent train service. The electric service took the mail from office to office in the same time that was formerly required to take it by wagon to the train. On the subject of compensation for this service, the author of the paper considered it a mistake that the electric railroads counted too much on the protection granted against the interference of strikers, and had consequently taken the mails at almost any price. The running of one mail car on a steam road gives an opportunity for carrying some twelve or fifteen passenger cars on the same train, which clears up the traffic for some time, but an occasional mail car train on an electric road does not serve to keep the system in anything like satisfactory operation or accommodate more than a very small fraction of the traffic. The result is that electric railroads are carrying mails for the bare cost of giving the service and are not getting the protection which they had hoped for. The present flat rates paid by the government of 3 cents per mile for pouch service and 16 cents per mile for 16 foot cars are considered

too low, and it was suggested that the members use what influence they could toward getting the government to increase these rates.

In the discussion of this paper C. S. Sergeant said that mail service on the street car lines of Boston began in 1895, with seven mail cars, which we equipped, and which originally made 43 trips daily. In 1898 the mileage will be upward of 170,000 miles. There were originally 13 stations, to which two have been added. Connections have always been made with the Boston and Albany and Providence depots, and the Union station. Sixteen men are constantly employed, eight conductors and eight motormen. Out of about 45,000 trips run (to January 1, 1898), there were 360 failures or irregularities, or about eight one-hundredths of 1 per cent., and those were almost wholly due to the snow and the consequent blockading of teams in the narrowest streets.

Seven cars handle 100,000 pieces of mail daily. The system is under the supervision of the New England superintendent of railway mail. In other cities the trolley and cable service is under control of the local postmaster. The General Superintendent of Railway Mail of the United States in his report for 1895 says: "In Boston, by reason of the fact that the street car lines are all under one management, we are able to move mail from one suburb to another, as, for instance, from North Cambridge and Cambridgeport to Brookline, by direct transit, the mail not being compelled to pass through the main office. There is probably no city in the country where the benefits of this service will be as great as in Boston, with its densely populated suburban districts, all of which have heretofore been at Cambridgeport, a 15 minute run, the mail for that station is about all ready for delivery to the carrier. This also applies to Cambridge and North Cambridge. Now this car receives all mail collected at the various stations and assorts it in the car, inward, for all outgoing trains, so that when it reaches stations en route for Boston the mail is all ready for immediate dispatch. Each car handles nearly 5,250,000 pieces of mail, or a total of 36,561,170 pieces for the seven cars in a year.

FIRST LARGE CRUISERS OF THE BRITISH NAVY.

AMONG the ships enumerated in an approximate summary of the shipbuilding and marine engineering work executed on the Thames within the past twenty-one years, given in the issue of The Engineer of December 30, 1898, two vessels were mentioned which it was our intention to have more fully noticed had not other pressing matter had claims on our space at the time. The vessels alluded to are H. M. first-class cruisers "Blake" and "Blenheim," sister ships; the first named built at Chatham, and engined by Messrs. Maudslay, Sons & Field, of Lambeth; and the second at Blackwall, by the Thames Ironworks and Shipbuilding Company, and engined by Messrs. Humphrys, Tennant & Company, at Deptford.

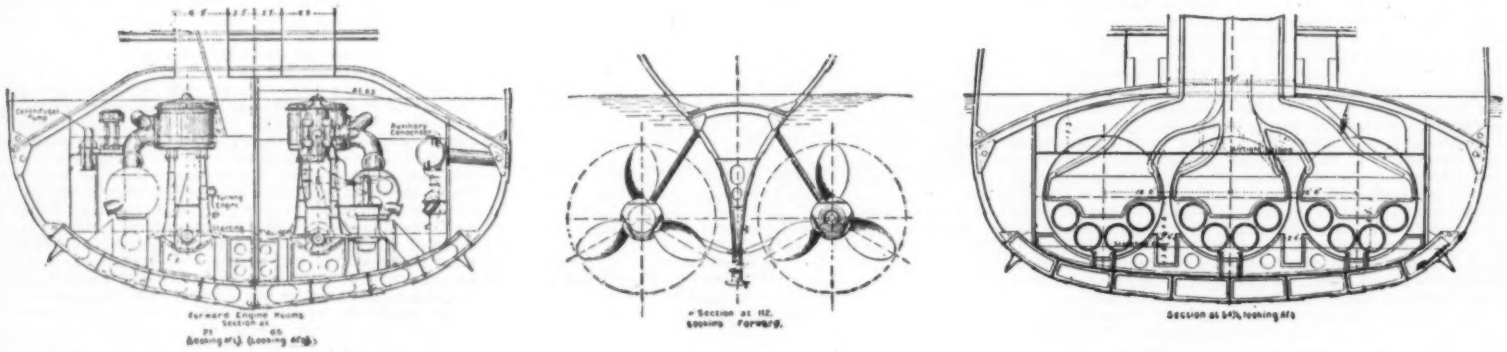
The internal arrangement and economy of a modern cruiser, though not of the very latest type, will be interesting to many of our readers not conversant with the details of ships in general, or those of warships in particular. We are glad, therefore, to be able to give them, through the courtesy of Messrs. Maudslay, Sons & Field, a section showing the interior of H. M. S. "Blake," the elder of the two sister ships before referred to—a vessel which, at the time she was designed, was the largest and most powerful unarmored cruiser ever proposed to be built for the British navy; and to explain briefly the purposes which each of the compartments shown in our supplement serves in the general economy of the ship. In what follows it will be understood that our descriptive matter applies equally to the "Blake" and "Blenheim," they being built from the same lines, of the same kind of material, and fitted in every way in a similar manner.

Before entering, however, into the detail of the internal arrangement of the ship, it is necessary that her principal dimensions, etc., should be stated, to enable the reader to appreciate the work which devolved upon her designer in providing within limited dimensions and displacement the necessary structural strength to make the ship an efficient fighting machine, adequate space for her propelling machinery and its adjuncts, room for the safe and proper stowage of ammunition, stores, etc., together with sufficient accommodation for the berthing of the whole of her officers and crew.

In the early part of April, 1888, instructions were issued for preparations to be made at Chatham Dockyard for the construction of a new type of first-class cruiser, designed by the Chief Constructor of the Navy—the present Sir W. H. White, C.B.—which was to surpass in speed, coal endurance, protection, and armament anything ever before attempted. The dimensions to be given to this vessel were: Length between perpendiculars, 375 feet; breadth, extreme, 65 feet; loaded displacement, 9,000 tons; with a mean water draught of 25 feet 9 inches. No such ship had been added to the British navy since the date—1861—of the "Warrior." She was to be constructed of steel, without side armor; but her vital parts were to be protected by a curved steel deck extending the entire length of the ship, and she was to have propelling machinery driving twin screws of 20,000 indicated horse power, to enable her to attain a continuous steaming speed at sea of 18½ knots an hour, or 22 knots at full power on the measured mile.

From the foregoing particulars of requirements, readers will not be surprised to know that in length, tonnage, displacement, and propelling power, the "Blake" was 75 feet longer than any of the belted cruisers then existent, had 4,000 tons more displacement than any previous vessel of her class, and her engines were fully 8,000 horse power in excess of those of a first-class battleship of her date. The tender for the construction of her machinery, by Messrs. Maudslay, Sons & Field, was accepted in August, 1888, and the vessel was launched at the end of November, 1889.

As the hull of the "Blake"—which is of soft steel—in its structural arrangements, calls for first notice in our brief description of the vessel, it will be seen, on an inspection of as much of it as is shown in our illustrations, that it is constructed on the cellular system, is double-bottomed, and is internally subdivided by a number of athwartship water-tight bulkheads. There are four principal decks, viz., upper, main, protective, and lower decks. The protective deck, shown by a white line extending from end to end of the vessel, curving downward forward and aft at the ends, is of turtle-back form and slopes down at its side edges to 6½ feet below the load water-line, while its high part



HER MAJESTY'S CRUISER "BLAKE"—BUILT AT CHATHAM DOCKYARD.

more or less restricted in their mail accommodations by reason of their mail having to go through the city post office. By the present system, the railway post offices centering at Boston can 'pouch' to the street car lines all mails for suburban points reached by them; and the street car lines in turn can gather up all the mail from suburban points and pouch it direct to the departing trains at the various depots."

The first practical illustration of a street railway post office was in Boston. Other cities had street railway mail cars first—St. Louis and Brooklyn—where the mail was simply carried in bulk and delivered the same as by wagon, not being worked in transit; but Boston street railway cars were the first to be patterned after steam railway cars, with racks and all appliances for working the mails in transit—transferring, so to speak, so much working space, and clerks, from the main post office to the post office on wheels, thereby losing absolutely no time in handling matter, and enabling the business man to get his mail early in the morning rather than late in the afternoon, with nearly a whole day saved for him. One car is equipped with an electric canceling machine, with a capacity of 2,000 cancellations an hour.

Let us follow a car to North Cambridge, and touching Park Square, Cambridgeport and Cambridge post offices en route. Take the first trip in the morning, where the postal clerk receives from the general office all the accumulations of mail which arrive during the previous evening from all parts of the country. Upon arriving at Park Square station (the train from New York with all mail from the South and New York State arrives at 5:30) this mail is delivered direct to the postal car, and the contents opened by the clerk and assorted for the carriers. Upon the arrival of the car on the middle line of the ship is 1½ feet above the water. On the slopes of this deck, which it will be seen is supported by deep beams for the length of the machinery and boiler space, the steel of which it is constructed is 6 inches thick, while on its flat parts the thickness is reduced to 3 inches; this protection being practically stronger than that of any then existent cruisers with similar decks, and comparing favorably with the deck protection of many foreign battleships of very much greater displacement. No side protection in the shape of thin armor was given to the ship, as it had been experimentally proved that even 4-inch armor was still penetrable by shells carrying high explosive charges.

As only two of the guns—the heavy ones—with which the "Blake" is armed are seen in our illustration, we may at this point in our description state the armament and kind of guns the ship carries, with their disposition on board. The armament consists of two 9·2-inch 22-ton and ten 6-inch 5-ton heavy guns, with sixteen 3-pounder quick-firers, and seven machine guns. The two 22-ton guns are, as shown in the illustration, carried on the upper deck, one forward and one aft, to serve as bow and stern chasers, having each an arc of fire of about 240°. Six of the 6-inch 5-ton guns are carried on the upper deck, two of them firing right ahead, two right astern, and two on the broadsides; the midship pair firing through an arc of 120°, or 60° before and 60° abaft the beam. The remaining four 6-inch guns are carried on the main deck, two on each broadside. To those of our readers who may be interested in the exact gun positions which obtained on board our first two large cruisers, we would refer them to our issue of July 11, 1890, in which is given a plan of the "Blenheim," sister ship to the "Blake,"

showing how all the guns on board were placed. In addition to the armament above detailed, the "Blake" is fitted with two submerged torpedo discharging tubes, and has her stem made with a formidable ram. As she has no external keel, it will be noted that the under-water part of her bow is gradually curved upward from the bottom, until it meets the end of the ram; and that at her after ends the deadwood, as it is called in a wooden ship, is partially cut away for some distance forward to facilitate and improve the steering and turning capabilities of the vessel. Both these features are considerably more pronounced in our latest warships. It will also not escape notice that the "Blake" is fitted with a balanced rudder of fairly large area, good turning power on her hull being thus insured, without a large force being necessary to maintain the rudder in position. With her double bottom, protective deck, and the numerous bulkheads in the ship, most of which are carried up to the main deck, all made perfectly watertight, it was considered that together they would maintain the buoyancy of the vessel should she be seriously damaged by grounding or in action. And with a view to still further protection of her most vital parts, included within the machinery space, which occupies nearly two-thirds of the length of the ship, she is shielded by coal at her sides, as well as over the slopes of her protective deck within the same length.

Internally, below the upper deck, the ship is practically divided lengthwise into four principal compartments, separated by transverse bulkheads; the first extending from inside the bows to the forward boiler-room bulkhead; the second, from this point to the forward engine-room bulkhead; the third is the space included between the forward and after engine-room bulkheads containing the propelling machinery; the fourth compartment extending from the last-named bulkhead to the extreme after part of the ship.

As our illustration depicts so clearly how the spaces between each of the decks in the four main compartments are utilized, and our space being limited, we confine ourselves to briefly stating, in reference to the first or forward main division of the ship, that its lowest depths, above the watertight platform, are principally appropriated to the small arms magazines for the stowage of ammunition; the compartments into which this space is subdivided by transverse partitions or bulkheads being capable of being instantly flooded in case of fire. In the space above the magazines between the lower and protective decks, the machinery and engines for working the capstan and windlass gear are fixed, and aft of this are the shell and torpedo rooms. Above the protective deck and between it and the main deck are seen the store rooms, chain cable locker, washing room, etc., and on the main deck are shown the interiors of the forecastle, store and mess rooms.

As the two intermediate compartments of the ship are her most vital parts and require fuller notice, we defer description of them until we have briefly shown how the fourth or after compartment of the ship is appropriated.

That part of the vessel immediately adjoining the after engine room bulkhead below the level of the lower deck and between it and the watertight flat is, in the space between the two propeller shaft passages, as far aft as the stuffing box bulkhead, utilized as magazines, the remaining part aft of that bulkhead being used for water ballast. As shown in the illustration, the sides of the shaft passages or tunnels, in which the thrust blocks are fixed, are made to serve the purpose of storing the spare gear for the main engines. Immediately above this part of the ship on the lower deck are the after magazines and shell rooms, and joining these still further aft, the steering engine and tiller rooms. On the protective deck above the magazine and shell rooms and near to the after engine room bulkhead is the engineers' workshop, the space on this deck further aft being occupied by stores. On the main deck over the engineers' workshop is the engineers' mess room and cabins, and on the same deck further aft the executive officers' ward room, with cabins at the sides, the state rooms of the officer in command of the ship being the farthest aft.

Directly forward of that compartment of the ship just briefly described is the one devoted entirely—below the protective deck—to the propelling machinery of the vessel. This compartment, as a whole, is divided by a middle line and two transverse bulkheads into four separate engine rooms, each watertight in itself, and containing a set of three inverted cylinder triple expansion engines, so arranged that each two sets on the starboard and port sides respectively can be coupled together for driving each propeller; or in case of damage to one set, it can be disconnected from the others, and so localize the injury sustained.

The type of engines, although favored by one foreign government, was as remarkable among previous marine engines in our own navy as the ship was among its ships, they being the most powerful hitherto applied to the propulsion of a man-of-war. The cylinders of each set were 36 inches, 52 inches, and 80 inches diameter for high, intermediate, and low pressures respectively, all with a piston stroke of 4 feet. Each set of engines has an air pump 33 inches diameter and 2 feet stroke; and a brass surface condenser with 2,250 square feet of tube cooling surface; the cooling water is supplied by a centrifugal pump with a 3 foot 9 inch diameter impeller, driven by an independent engine, the pump being adapted to draw either from the bilge or the sea. Each two sets of engines drive an 18 foot 3 inch diameter screw propeller, having a mean pitch of 24 feet 6 inches.

The protective deck covering the engine space, it will be noticed in the illustration, is dome-shaped, and rises to a sufficient height above the cylinder tops to allow of their covers being removed, it being for protection at this part from 6 inches to 8 inches thick. The four engine rooms are kept cool by air fans 4 feet 6 inches diameter, the air being carried below by the cowl-surmounted ventilators shown. Above the machinery, and between the main and upper decks, the space is occupied, as shown, with galley, bakehouses, pantry, etc.

Immediately adjoining the forward engine rooms is the boiler or steam generating compartment of the ship; this, it will be seen, is bounded at either end of its length by athwartship coal bunkers, which being connected to those at the ship's sides at this part afford great protection to its contents. This comprises six double-ended four-furnaced cylindrical return-tube boilers, and one auxiliary single-ended boiler. The double-ended boilers, designed for a working pressure of 150 pounds per square inch, are each 15 feet 2 inches diameter and 18 feet long; placed side by side, and fired fore and aft as shown in illustration; the auxiliary boiler for supplying steam to all the auxiliary engines in the ship—about sixty in number—being 10 feet diameter and 9 feet long; the total heating surface in the main boilers being nearly 27,000 square feet, with 863 square feet of fire grate; the heating surface in the auxiliary boiler being 900 square feet.

Each set of three main boilers, it will be noticed, is in separate boiler rooms, divided from each other by transverse bulkheads; the small boiler being located between these. The products of combustion are carried off from each triplet of boilers by one funnel, that from the small boiler being led into the uptake of the after set, ample air being supplied to the stokeholds by the cowl-mounted ventilators shown; the ventilator shafts serving also for conveying the waste ashes to the upper deck by means of the ash hoists fitted to them. For the attainment of high speed for which the ship was designed, the main boilers are fitted for the application of forced draught to the furnaces with closed stokeholds, twelve fans, 5 feet 6 inches diameter, driven by independent engines, being supplied for that purpose. The coal bunker capacity of the ship is 1,500 tons—one-sixth of her load displacement—sufficient to enable her to cover a distance of 15,000 knots at a 10-knot speed.

Having briefly described the internal arrangement of the "Blake" below the decks, we have now to note the few erections, etc., to be found upon her upper deck, and the appliances for handling the boats, etc., carried by the ship. It will be observed by the reader on looking at her illustration that with the exception of the raised forecastle deck forward, the upper deck is flush from end to end. Upon it, at what is known as the "break of the forecastle," the most important erection is the "conning tower," having above it the upper and lower forward bridges. This tower, which has its foundation below on the protective deck, though not large, is a massive structure, usually circular in form, made of rolled steel plate, some 12 inches thick, above the upper deck, diminishing in thickness toward its base. From this tower is seen all that is taking place on deck and around the ship when in action; and it contains within it all the necessary means of communication with the different stations in the vessel for controlling her when under fire. On the lower bridge, directly over the conning tower, are the bridge telegraph, the binnacle, wheel, and chart houses. The ship has two steel pole masts with flag topmasts, but no sail power, with the exception of a fore staysail for steadying purposes. Both masts are fitted with derricks, the after one being a substantial spar used for hoisting in and out the steam vedette boat and pinnace carried in chocks on the deck.

A flying gangway connects the forward and after bridges, the latter having on it a chart house with signal flag lockers, etc. Directly aft this bridge is a small director tower, with sighting holes for torpedo firing purposes. The only other erections on deck, though not fixed ones, are the armored shields for the two big guns, these being semicircular in form with sloping roofs; the guns being on the central pivot system. The shields move with them when being trained. In addition to the two large boats carried inboard, the "Blake" has ten others, carried on davits along her sides. Electricity supplies light throughout the ship, it being generated by three Siemens dynamos, driven by a Willans engine, each capable of producing a current of 400 amperes.

Although the power developed by the "Blake's" engines on the forced draft trial did not quite come up to that contracted for, that given out by them under natural draft exceeded the contract—14,000—by as much as 1,535 indicated horse power, with less than the Admiralty limit—¼ inch—of air pressure. On the mile the speed realized by the ship was less than was anticipated in proportion to the power developed by the engines, but with the actual air pressure used on the natural draft trial—0·42 inch—the boilers worked remarkably well.—The Engineer.

AUTOMATIC PISTOLS.

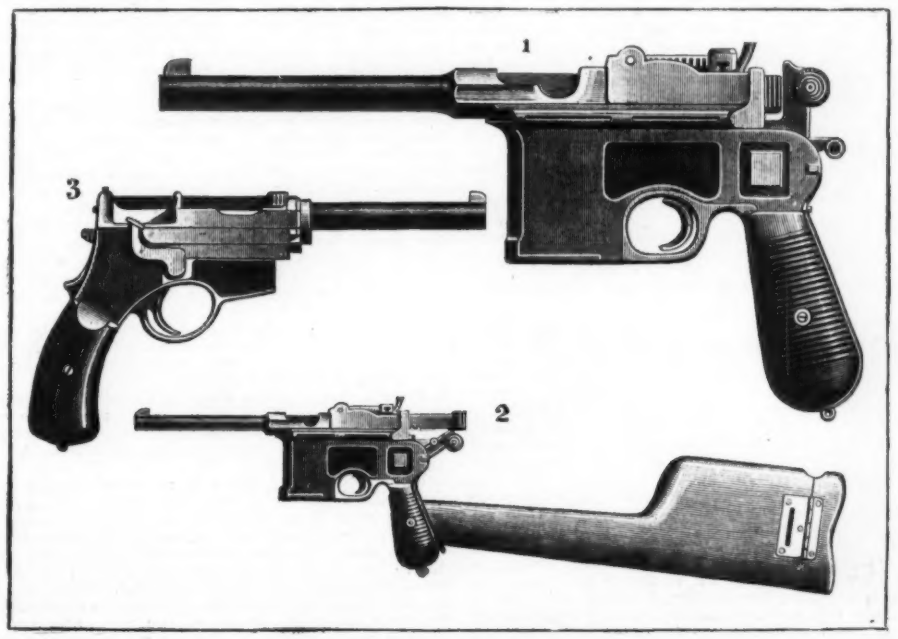
It is only within the last four or five years that inventors have devoted their talents to the production of automatic pistols. The first of these weapons that appeared was that of Borchard, which was soon followed by those of Mannlicher, Mauser, Schwarzlose, and others.

The characteristic feature of an automatic pistol is that it requires merely sighting and a pressure upon the trigger. Exactly as in the Maxim gun, the gas from the powder not only expels the projectile, but, through its force of expansion, keeps the weapon always in a state to be fired. Automatic pistols are therefore rapid-fire weapons par excellence. They even realize the ideal of rapidity, and skillful marksmen have been known to fire as many as seven shots a minute with them.

In one of these pistols, after a shot has been fired, the expansive force of the gas effects the opening of the breech, extracts and ejects the empty cartridge shell, cocks the hammer, and compresses recuperative springs which, through their action, afterward effect the loading and closing of the weapon. All these motions take place within a fraction of a second.

Automatic pistols may be classified in three groups, according to the manner in which the action of the gas occurs. In the first group the gas pushes back the closing piece through the intermedium of the base of the cartridge shell. In the second group, the gas escapes through a vent formed in the barrel, and acts upon the closing piece through the aid of peculiar transmitting devices. In the third group, the closing piece is stationary and the barrel detaches itself therefrom, as a consequence of the sliding of the ball in its interior. The majority of automatic pistols belong to the first group, and among these, the Mannlicher and Mauser weapons. We shall confine ourselves to a general description of these two latter, which have much analogy with each other. We shall not enter into a detailed description of their parts and of their operation, as this would take up too much space.

Automatic pistols, with their numerous parts, springs, cams, screws, etc., are true pieces of clock work; and we cannot help concluding that such weapons, by reason of their great complication, could not constitute weapons of war, which in order to be utilized must be very simple and strong.



AUTOMATIC PISTOLS.

1. The Mauser pistol. 2. The same converted into a carbine. 3. The Mannlicher pistol.

One of the peculiarities of the Mauser pistol is that it can be converted into a carbine through the intermedium of its case, which is capable of being used as a butt end. This innovation is perhaps not very happy, since the weapon thus employed can no longer be used with the same facility as a pistol, and would form a very inferior sort of carbine by reason of the relative feebleness of the initial velocity of the ball.

The same inventor, in addition to a pistol of 7·63 mm. caliber allowing of the firing of ten shots, and which he proposes for the armament of troops, manufactures weapons of a caliber of 7·63 mm. and 6 mm. affording from 6 to 20 shots. The weight of these various weapons varies from 940 grammes to 1·3 kilogrammes.

The following are the characteristics of his 10-shot pistol of a caliber of 7·63 mm.:

Total length	290 mm.
Number of grooves	4
Pitch " "	250 mm.
Total weight of weapon empty	1·18 kg.
Length of cartridge	35 mm.
" " ball	13·8 "
Weight of cartridge	10·7 grms.
" " ball	5·5 "
" " powder	0·5 "
" " case	440 "
Initial velocity of projectile	425 m.
Thickness of wood traversed at 10 m.	27 cm.

For the above particulars and the illustration we are indebted to La Nature.

The Urals will, according to Prof. Louis, of Newcastle, for many years to come be able to supply the extensive regions of Siberia with charcoal iron cheaper than iron made with mineral fuel can be imported. As communications improve, however, this advantage will constantly diminish.

RUSSIA'S GREAT NAVAL ENTERPRISE.

THE introduction of the railway, as a factor in the development of the resources of Siberia and Central Asia, is justly regarded as marking an epoch in the history of the Russian Empire; but, so far as Europe is directly concerned, the political and economic advantages resulting from this great achievement are of comparative insignificance to the latest project of the Russian government—the establishment of naval and commercial communication between the Baltic and the Black Seas. This is to be accomplished by means of a waterway, extending from Dunamunde, in the Gulf of Riga, to Kherson, on the estuary of the Dnieper.

Although the importance of the new undertaking, when judged by the strategic and commercial advantages likely to accrue from it, is comparable to that of the great railway, it will be even more remarkable as an engineering exploit; while the outlay of money involved—a not inconsiderable sum—and the time occupied in the work will, in view of the magnitude of the enterprise, be relatively insignificant. It is estimated that when the railway is finished, the total cost will have amounted to 400,000,000 rubles, while the revenues will, for a long time to come, be unimportant, and out of all proportion to the money invested; but from the new enterprise there will be considerable and immediate returns when the waterway is opened for traffic.* The waterway, when first projected, was estimated to cost £20,000,000, and the work was to be completed in five years.†

The Siberian Railway traverses a country which, to an area of 400,000 miles, has only 100,000 inhabitants, while the cities and towns connected by it are yet in their infancy; whereas the waterway across western Russia will connect important cities and towns already in a flourishing condition, which, with increased facilities for the export of their produce, could double, and even treble, their present output.

These great cities, such as Kief, Kremchug, and Ekaterinoslav, will be in direct communication with Kherson in the south and the port of Riga in the north. At present, although the Dnieper for hundreds of versts is the highway of traffic, the rapids, about 217 miles above the city of Kherson, entirely divert trade from the latter city, most of it going overland to Nikolaief and Odessa. I purposely refrain from mentioning in this connection cities like the capital of Minsk, through which province the route will lie, for many towns, now unimportant, being on the main artery of intercourse between the northern and southern ports, will increase in importance at the expense of the old-established centers not so fortunately situated in this respect; while others will spring up in a short time at the confluence of navigable rivers—such as the Prypet, the Desna, and the Svislotche—with the Dnieper, that will in a very few years surpass in importance any yet existing.

The whole course of the waterway will lie through some of the most naturally productive, if not the most producing, "governments" of the empire, and goods usually transported by rail from Odessa will go much cheaper via the waterway of St. Petersburg. The enormous and ever-increasing output of petroleum, salt, iron, and other products of the Western Caucasus and Don Cossacks, with which the Vischnei-Volotschosk Canal‡ is inadequate to deal, can be transported via the Don, the Straits of Yenikelye, Kertch, and so on to the Dnieper and the Baltic; returning with rye from Minsk and Vitebsk, and wheat from the provinces of Kiev and Podolia—the best grown in Russia—for there is nearly always a scarcity of these commodities in the mining districts before mentioned.

But leaving commercial considerations for the moment apart, let us consider this enterprise with regard to its strategic importance, and we shall find that what the railway system is to the army, the canal will be to the navy. While the former enables Russia to mobilize her troops with an economy and dispatch formerly impossible, the waterway will enable her to concentrate her naval strength in either the Baltic or Black Sea, as occasion may require—an achievement altogether impossible under the present circumstances.

For some time to come, Russia will probably rest content with her recent territorial acquisitions and occupy herself with their internal development; but can we reasonably expect that, should opportunity occur, such as would be furnished by a general European war, for instance, she would not avail herself of it to extend her waterway to the Mediterranean via the Black Sea and Bosphorus? The Bosphorus is, in more than one sense, a continuation of what will be the great naval waterway, for the entrance to the former will be just opposite to the exit from the latter, and it is a geographical, or rather a hydrographical fact, that the influx of fresh water into the Bosphorus is due to currents that cross the Black Sea direct from the mouths of the great Russian rivers. There is no knowing when Russia will be in a position to promote a European conflict—for while the peace doctrine is preached abroad, it is vigorously suppressed at home—and, under such circumstances, the intercommunication between her northern and southern naval establishments will enable her to muster all her available battleships in the Black Sea, and almost before the Powers realize her object.

I need not point out that such a waterway could easily be rendered impregnable; but I may observe that the estuary of the Dnieper is not less than 15 miles long and six broad, with a great arm of land stretching out into the sea, which, well fortified, would command the entrance not only of the great waterway, but of the River Bug as well. The naval docks of Nikolaief are situated on the latter river, practically inland, behind Kherson.

It would be going beyond facts to assert that this undertaking will make Russia a great naval Power; but it will at least strengthen her position, and, while she will be a constant menace to Constantinople, it will render her practically unassailable in her own waters.

The route to be taken in constructing the waterway is marked by three rivers, the Duna or Dwina, the Beresina, and the Dnieper, all united by means of a canal and tributaries of the two former in the province of Lithuania, in the government of Minsk. In this district the land is flat and marshy, though fertile in parts; but a little north of Minsk there is a ridge of low hills which determines the course of a number of small streams, that flow thence in opposite directions, some north to the Baltic, others to the Black Sea. Two of these streams are the Ulla and Sergatch, the former a branch of the Duna, the second a tributary of the Beresina. The latter river flows into the Dnieper at the eastern extremity of the Pinsk Marshes. The connection between the Duna and the Beresina is effected by a canal,* which unites the Ulla and the Sergatch. By this means commercial intercourse was instituted in the early part of the century from Dunamunde, in the north, to Ekaterinoslav, in the south. Below the capital of this province, however, navigation is interrupted for a distance of 40 miles.

The Dnieper flowing through the provinces of Smolensk and Mohilev is unnavigable till it joins the Beresina at Goryal, in Minsk; but it becomes deeper and broader all the way southward as far as Ekaterinoslav, a matter of nearly 600 versts (or 400 miles). The Beresina is navigable for vessels of moderate draught; but as the great waterway is to be of a uniform depth of 28 feet—a foot deeper than the Suez Canal—the channel of the water course will have to be considerably deepened. The depth of the Dnieper will also have to be increased, especially where it passes through the Pinsk Marshes, and what we should call forests, but which are known locally as the polyesiye (the woods).

The river Duna, from Polotsk to the Gulf of Riga, is navigable for ordinary traffic, but only during the spring floods for larger vessels. All Russian rivers get shallow as they approach the sea, and even at Riga, one of the most important shipping ports on the Baltic, vessels drawing more than ten feet of water cannot enter the inner harbor. Riga stands five miles above the mouth of the river, the harbor being in reality at Dunamunde, where there is a fortress appropriately situated to command the entrance of the future great naval waterway to the Black Sea.†

The deepening of the bed of the Duna from the Gulf of Riga to Polotsk will entail much labor and time, but will offer no serious obstacles that skillful engineers will not be able to overcome. The chief obstructions to traffic are loose, sandy formations and aquatic vegetation of the Butomus umbellatus species, which sometimes grows to 22 feet in length.

The Dnieper below Kiev is very deep and broad, but the depth varies, owing to huge masses of drifting sand. Practically speaking, however, it is navigable for ships of heavy draught for the 150 miles that intervene between this city and Ekaterinoslav. Ekaterinoslav is situated immediately above the rapids called by the native Porogi (literally steppes) that stretch away for 40 miles to Alexandrovsk, whence to Kherson, another 200 miles, the river again becomes navigable for vessels of moderate draught.

From Kremchug the river flows calm and smooth, though here and there great masses of granite stand out of the water; to careful navigation they are no serious obstacle, however, as the river is broad, and the channel deep.

From Kremchug there is a great change in the formation of the river bed. On reference to a map it will be seen that the river takes a turn in a southeasterly direction, a few miles above Ekaterinoslav. This is due to a great plateau of granite that resists the full power of the stream, and forces it through a sand-formation of the tertiary period. This solid mass of granite is a natural dam, which holds back the flood between the steep banks of the river, and accounts for the great depth of the water. Peitzhold, in his book, "Reise im Westlichen und Sudlichen Russland," observes that, had not the water succeeded in breaking through the solid granite at Ekaterinoslav, Russia would have one great river the less flowing into the Black Sea. Continuing in a southeasterly course, and uniting with the river Don, it would have debouched into the Sea of Azov, by Taganrog. The force of the water, however, burst through the mass of granite below Ekaterinoslav, and the river now, with a rage that is indescribable, hurls itself down the 40 mile incline marked at intervals by the Porogi. Ships have to be unloaded at Old Samara above the falls, their merchandise being conveyed 40 miles overland, and reshipped at Alexandrovsk, from which town the river is again navigable the rest of the way to Kherson—an unbroken stretch of 200 miles.

Under these circumstances it is scarcely to be wondered at that merchants prefer to send their wares by rail to Odessa or Nikolaief, and that Kherson, the capital of the government which includes the two former towns, should take second rank. Kherson has, perhaps, the best position of any port on the Black Sea, and were it not for the rapids of Ekaterinoslav would command the export and import trade from and to the cities and towns on the banks of the Dnieper, Beresina and Duna, a distance of 994 miles—that is, from the Baltic to the Black Sea. The present state of things will, of course, be remedied when the waterway is constructed, and then, doubtless, the great trade of Odessa and Nikolaief will, together with the shipping, be transferred to Kherson, which offers a sure and secure harbor. The estuary of the Dnieper is 15 miles long, and from four to six broad, being sheltered by a great arm of land, that not only commands the entrance to the waterway of the future, but to the mouth of the Bug—that is, the approach to the Naval Docks of Nikolaief—as well.

The opening of direct communication with the Baltic will result not only in the transfer of the trade and shipping to Kherson, but the export produce from the interior will find its way thither too. The immense amount of traffic, by means of queer flat-bottomed boats, between the interior of Poland and the Black Sea will no longer follow the course of the Bug, but, taking the River Prypet, which is eminently suitable for this kind of navigation, will strike the main waterway a hundred miles above Kiev, and float down with the current to Kherson. At present the river craft mostly go by the Bug to Nikolaief, and by the Dneister to Odessa.

The most difficult part of the enterprise will be the circumventing of the cataracts, and to accomplish this many attempts have been made. 1. By blowing up the Porogi themselves. 2. By constructing canals. Fifty years ago a canal from above the falls to the Black Sea, via Nikolaief, was projected. It is just possible, but by no means probable, that this project will be realized; for below the falls the river is navigable, as I have observed, for 200 miles, and to cut a channel for 40 miles is a lighter undertaking than to deepen and widen a shallow stream for 200.

The throwing up of dams, in the shallow parts of the Dnieper, would serve to deepen the lower river as the granite obstruction does the upper. The river as it flows into the province of Kherson is very broad, and, save in mid-stream, very shallow. Therefore, the surface of the water could undoubtedly be raised by this means; for although the country is almost flat, being a gradual depression extending for many miles from the interior, it is high above the river bed, so there would be little danger of an inundation, especially if a few locks were constructed to meet the emergencies that might arise in the spring.

After the breaking up of the ice, when the water is very high, the rapids of Ekaterinoslav are sometimes navigated by small boats, rafts, and even barques of light draught, the owners being tempted to make the perilous passage by the desire to avoid the cost of transport overland; but merchandise of any value is rarely conveyed in this way.*

Not only are the Porogi† to be feared, but there are innumerable rocks and shallows still more dangerous, because less accurately known. These latter create whirlpools that frequently draw vessels to destruction, in spite of the extraordinary skill with which they are maneuvered.

Although immense amounts of timber are floated over the rapids and down stream to Kherson, the route is, to all practical purposes, closed to traffic at Ekaterinoslav.

The construction of the waterway will involve the cutting of a canal between the latter town and Alexandrovsk; but to avoid the necessity of blasting the granite formation, which might be attended with serious consequences owing to the pressure of the river, it will probably be made to skirt the granite plateau and join the main river higher up.

Of the great cities and towns situated on the main waterway the most important is Kiev, the recognized center of commerce for Southwestern Russia. Not only is the produce of the surrounding country brought thither down the tributaries of the Dnieper, but great impulse has been given to manufactures.‡

Kremchug, which is situated at the confluence of the Pset with the Dnieper, has progressed evenly with its neighbors; manufactures are making great progress, and agricultural implements, which used to be imported at Odessa, are manufactured here, the iron being mined in the neighborhood. When we consider the enormous amount of land under cultivation, no more need be said of the prospects of this new industry.

But it is in the government of Ekaterinoslav that the most extraordinary progress is being made. At the end of the last century this province was a wilderness, peopled only by a few nomadic Tartar tribes; at the present time it is the best populated province in the empire.§

The great progress made in the districts of Little Russia is not to be wondered at; with such undeveloped resources it is a matter for surprise that it has not been more rapid. Take the government of Minsk, for instance. True, it is marshy and unhealthy, and is considered one of the poorest districts in Southwestern Russia; but it can boast a list of industries that any English county might envy. It produces more corn than is needed by the inhabitants, but little is exported, owing probably to the lack of facilities for cheap transport. Hemp, flax, rye, are cultivated, and great trade is done in leather. Horses and cattle are reared, and iron is mined. Other industries of equal importance have been introduced within the last few years.‖ This great progress in industries is not a little due to the German colonists, of whom there are some 25,000 in the province of Minsk alone. In the north they are even more numerous.¶

What might not be expected of a country with such natural resources under proper administration and with facilities for transport cheaper and more direct than the railway!

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* The public are led to suppose that the traffic on the Siberian Railway is greater than is actually the case; for in the official reports of the thousands of passengers transported east, and the millions of poods of goods conveyed west, no mention is made of the fact that the imposing totals include soldiers and government stores.

† Although this estimate of the time it will take to construct the waterway is generally accepted, I think it highly improbable, in view of the enormous obstacles to be overcome, that it can be completed in less than eight or even ten years.

‡ This canal traverses central Russia from the Baltic to the Caspian Sea, and it is estimated that not less than 6,000 barges pass along it annually. Water communication for lighter traffic exists by no less than three different routes between the Baltic and the Black Seas; the total length of navigable waterways in European Russia, including rivers, canals, and tributaries, is no less than 21,553 versts.

* This canal was projected in 1797, and finished in 1801-3.

† The whole route is lined by great fortresses, some of them of great antiquity. They mark what was formerly the frontier of Poland, prior to the absorption of that country into the empire. Those of Borosov and Bobruisk, on the Beresina, are the most noted, the latter having held out successfully against Napoleon when the French marched on Moscow. They are now important as commercial centers, and when the great waterway is constructed, they will, undoubtedly, attract most of the trade of the province from the capital, which stands some fifty miles back on the Switschlock, a tributary of the Beresina.

* Alexandre Peitzhold records that, in the years 1832-4, no less than 49 ships and 107 rafts were wrecked and 30 men drowned. In the year 1842 the passage was wholly impassable, and a boat that attempted to make the passage was literally ripped up (reisen) in the space of one second.

† The Porogi are ten in number. The Kaidak Porog is half-a-verst below Woloschniow; the next is the Lochanski, half-a-verst below the Kaidak; at the distance of another half-verst is the Woionski. Between this and the Porog of Sworonetz two versts intervene, and also another two between the Sworonetz and the Ne-Nasytetz. The remainder at various shorter distances apart are called the Wolmachski, the Lachnoi, and the Wolnoi respectively. They have a total fall of 107 feet. An exhaustive account of these Porogi is given by Alexander Stuckenberg, in his great work, "Hydrographie des Russischen Reichs," vol. iii., pages 252, 253, 254.

‡ In 1638 Kiev (the town) had a population of 17,089; at the present day it numbers nearly 200,000. Large sugar refineries and tanneries have started up, also steam flour mills, chemical and iron works. Woolen cloths are also manufactured, while great trade is done in hides, tallow, sugar, glass, china, saltpeter, which are transported to Odessa by rail. The great fair of last year showed returns amounting to one million sterling.

§ The population, which in 1830 was 600,000, increased in 1860 to 1,138,000, and in 1888 it amounted to 1,905,540. The southern extremity of this province commands the trade of the Sea of Azof.

‖ But here, as almost everywhere else in Russia where there are forests, timber cutting is the chief industry.

¶ Germans are about 5 per cent. of the population of the south, but in the north, especially on the Duna, the descendants of the early Teuton settlers have the commerce almost altogether in their own hands. They have completely germanized the country; the names of the cities—Friedrichstadt, Jacobstadt, Dunamunde, etc.—bear witness to this. Notwithstanding the government policy to encourage foreigners, they are beginning to draw the line at having foreign names for their cities and fortresses, and some time ago a decree was issued by which Dunaburg is to be called Dwinsk. I doubt if Dwinsk will be substituted for Duna, for a Polish or Russian equivalent for Dunamunde would cause considerable trouble to foreign navigators on the Baltic

The government entertains the project for a waterway across western Russia chiefly for its strategic value, but the commercial advantages to be derived from the undertaking are not ignored. Alexander III. was the first to give the project serious attention, and by his direction a survey was made. When the present Emperor was approached on the subject, he referred the matter to the Ministries of Finance and of Ways and Communications. But although extreme reticence is observed in official circles and imposed on the press, there is no doubt that the establishment of naval intercourse between the two seas is but a question of time. A desire on the part of the government not to increase the national expenditure, which has during the last few years been enormous, prevented this enterprise being promoted in 1897; but for such an object there would be plenty of money forthcoming if the Russian government, instead of drawing on the national funds, sanctioned the formation of a private syndicate.—The Fortnightly Review, by permission of the Leonard Scott Publication Company.

THE PREPARATION OF VERMOUTH IN FRANCE.

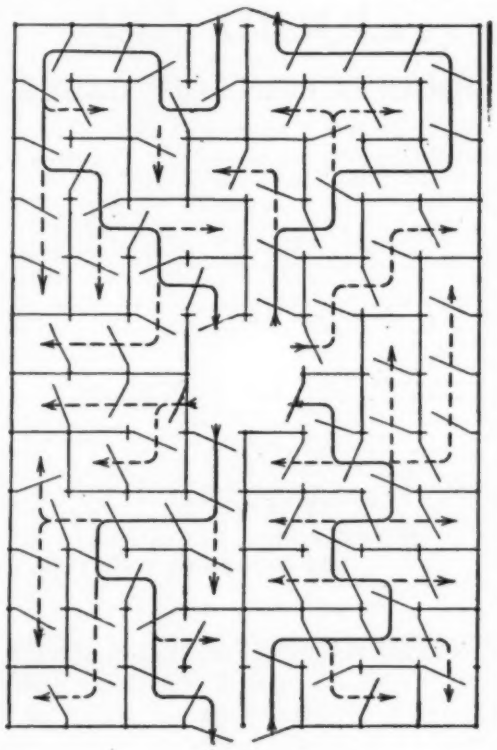
THE manufacture of vermouth in France is confined almost exclusively to the city of Marseilles, where all the important manufactories exist. The article is made from ordinary white wine, which is produced extensively in the region of which Marseilles is the principal center and which on account of its abundance is very cheap. A pure, wholesome white wine may be bought in the South of France at an exceedingly low price. While returns showing the production of wine in France are published every year by the government, no statistics are kept concerning either the production, consumption, or exportation of vermouth. The two principal points in Europe from which vermouth is exported are Marseilles and Turin. Vermouth, according to the United States consul at Havre, is simply an infusion of certain plants and bitter aromatic herbs and roots in a quantity of wine, the degree of which has been strengthened by the addition of one-ninth of its bulk of alcohol, in order to bring the wine, which is usually of not more than 10° alcoholic strength, up to 15°. The alcohol used should be pure, clear, and of about 85° in strength. The following are the ingredients of ordinary French vermouth: Dry white wine, muscatel wine, wormwood, bitter orange peel, camomile, water germander, Florentine iris root, centaury, Peruvian bark, aloes, cinnamon, nutmeg, alcohol at 85°, and raspberry juice. The herbs and other ingredients are sometimes allowed to remain in the wine for a period of two months, the solution being stirred every fifteen days. After the expiration of two months the wine is drawn off into another barrel and is allowed to remain therein for two weeks, after which it is drawn off a second time. In the event of the vermouth being cloudy, which is often the case, the manufacturer resorts to the simple process known as collage, which consists of stirring in some boiled milk in the proportion of 1 pint to 26 gallons of vermouth. The white of a single egg, well beaten, for each 26 gallons, or about half a fluid ounce of fish glue, is also used for this purpose. The vermouth should be allowed to remain in the barrel for about 5 days after the collage, after which time it may be drawn off and filtered. If the vermouth thus made is not sufficiently sweet, a little sweet wine or sirup may be added. Its degree of sweetness, however, should not exceed 5° to 7° on the Baumé scale. Newly made vermouth has a flavor of herbs, which is occasionally a little too pronounced. Age alone causes the disappearance of this. Certain manufacturers, instead of putting the herbs and other ingredients directly into the barrel, first inclose them in a linen sack, which is then suspended in the barrel of wine. The sack is withdrawn every five or six days, the liquid expressed from it into the wine, and the sack again suspended. It is left in the wine for a month, at the end of which time it is taken out, all the liquid pressed out of it, and the fluid thus expressed returned to the barrel. Other manufacturers first make an alcoholic extract of the ingredients, which extract is afterward mixed with the wine in the proportions given below. To obtain the alcoholic extract referred to, it is but necessary to reduce the dry ingredients mentioned to powder, and to place the same in about 10 to 12 quarts of alcohol of 85° strength. The solution is allowed to remain standing for a week, after which 19 quarts of alcohol and 7·35 quarts of white wine are added, together with the herbs cut into small pieces. The solution is then warmed in a water bath, which should not be heated above 140° Fahrenheit. After half an hour's warming it is removed from the fire, allowed to cool, and to remain standing for eight or nine days, during which time it should be frequently stirred in order that the sediment may be brought as much as possible in contact with the liquid. The solution, when perfectly clear, is placed in a large glass vessel, and forms an extract of vermouth. To make the article of commerce, 1·58 quarts of the extract are mixed with 2·11 quarts of white wine. If, in the simple process of infusion first described, the addition of alcohol to the wine precipitates the tartar contained in the latter, and causes cloudiness, the solution should be allowed to stand a few days until it clears, after which the solid ingredients may be added. The quality of the vermouth manufacture in France depends in a great measure upon the sort of wines used. The wines most employed are those of the valley of the Rhone, certain Spanish wines, and the wines of the extreme south of France. There is a difference between the French and Italian vermouth. A number of French manufacturers make Italian vermouth, however, not for the purpose of deceiving the customer as to its origin, but merely as a type of vermouth, distinct in flavor from the article known as French vermouth. The following are the ingredients which enter into Italian vermouth: Sweet white wine, wormwood, helenium, calamus odoratus, centaury, holy thistle, water germander, cinnamon, angelica root, gentian, nutmeg, fresh orange sliced, and alcohol at 85°. When the process of infusion, above described, is completed, the manufacturer, or an expert connoisseur identified with his manufactory, samples the vermouth in order to find whether or not it possesses the desired taste. Should the beverage be too bitter, the fault can be remedied by adding a small quantity of wine until, little by little, the proper flavor is reached. If not sufficiently bitter, a small quantity of the solid ingredients may be again infused in the wine. Nor is it necessary that vermouth should possess great alcoholic strength to be good. Some manufacturers make vermouth which contains 17° of alcohol, while others keep their product down to 13°. The average strength is from 14° to 15°.—Journal of the Society of Arts.

AN OPEN MAZE.

THE accompanying sketch from The Street Railway Review represents an "open maze" which doubtless would prove an attractive feature at almost any park where other than natural attractions are provided. It can easily be built by almost anyone and at small expense. The size of the maze and the arrangement of the true and blind paths may be varied according to the means and ingenuity of the builder. One of the points to be observed in laying out the plan is to have as many cells as possible with more than one door.

The Albany & Troy Steamboat Company has a park on an island in the Hudson River near Troy, in which is an open maze with 96 cells each about 4 feet square. The foundation consists of stringers laid on the ground and covered with planks, making a floor about 32 × 48 feet.

On this floor are set posts of 2 × 4 inches, pine, about 6 feet high; they are placed 4 feet apart each way and fastened to the floor by knees made of strap iron. The tops are fastened and braced by 6 × 1 inch planks running both crosswise and lengthwise of the maze. The partitions, or sides of the cells, are made of rectangular frames covered with wire netting such as is used for fencing chicken yards. The immovable partitions are exactly similar to the doors save that they are nailed in place instead of being swung on hinges. Spring hinges are used, so that the doors are all self-closing. The doors are hung to the posts, a cleat being placed on the opposite post, so that the doors swing only one way.



OPEN MAZE.

In the center is a large cell, 8 × 8 feet, through which both of the paths lead. As shown in the sketch, one may start at either end and go to the center and then return to either end. The doors are so hung that they swing away from the person going through except when he has strayed from the true path into a cul-de-sac and must retrace his steps, then the doors open toward him.

THE CATALOGUE OF SCIENCE.

PROF. CYRUS ADLER, Librarian of the Smithsonian Institution, presents in full the work of the second conference, the object of which was the publication of "The International Catalogue of Scientific Literature."

The first conference having been held in 1896, the second one met in London on October 11 of last year. Not less than eighteen countries were represented, and the United States by Prof. Adler.

One main point under discussion, says The New York Times, was the method to be employed in classification of works, and Prof. Michael Foster, representing the Royal Society of London, proposed that "each of the sciences for which a separate schedule of classification is provided be indicated by a Roman capital letter (hereafter called a registration letter) as a registration symbol." For instance, beginning with mathematics, that would be the letter A, and anthropology Q. This proposition met with much opposition, the difficulty being the arrangement of the various subjects. The specialists wanted a distinctive prominence to be given to their particular subjects. Finally the resolution was unanimously agreed to.

It is proposed that a separate schedule be provided for each of the following branches of science: Mathematics, astronomy, meteorology, physics, crystallography, chemistry, mineralogy, geology (including petrology), geography (mathematical and physical, excluding political and general), paleontology, anatomy, zoology, botany, physiology (including pharmacology and experimental pathology), bacteriology, psychology, and anthropology.

The opinion of the conference differed as to the language to be used in writing and engrossing the titles of books or papers on the "primary slip." Prof. Foster's idea was that the full title should be given in the language it was written in, but limiting the languages to English, French, German, or Latin. In case the language was one other than these four, it should be translated into English. Then Prof. Foster made an amendment that Italian should be added. Then arose, as was to be expected, the discussion as to the usage of Latin. Dr. Brunchorst, the Norwegian representative, made the statement that within a few years the Latin language will have disappeared from use in Norway, and that there would probably be no public school in Norway in which Latin could be studied. Dr. Adler held that every title should be given in the language in which the paper is written, without any exception whatsoever. Profs. Foster and Armstrong both pointed out that some translation of titles was necessary, but Dr. Adler stated that, while translations of titles might be given when necessary, the original title should also be given, either in the original character or in a transliteration. It was agreed to omit Italian, but retain Latin, and the first part of the resolution was then carried.

The classification subject being, after all, the most important one, M. Chevalier Descamps, the representative from Belgium, objected to the symbolic method. Prof. Arthur Rücker of the Royal Society of London controverted the opinions of M. Chevalier Descamps. The most striking portions of Prof. Rücker's speech were as follows, and with Prof. Adler we think that most American men of science will agree with the gentleman of the Royal Society:

I very much regret, speaking for myself, that I find myself at variance with him on several fundamental points. In the first place, he urges us to adopt the scientific system of classification, which shall not change from five years to five years, or ten years to ten years, but which shall hold good for all time or for a very long period of time. One of the very great advantages of our system is that we recognize that science is a growing subject. The notation that fits it to-day will not fit it next year, or ten years hence. Let us suppose scientific knowledge had sooner led us to recognize the close relation of electricity and light. Surely the mode of division would be quite different. The definition of zoology before and after Darwin would have been different. A classification which then appeared to be scientific would now be recognized as inadequate. The very first thing we must recognize is that our scientific knowledge is imperfect and growing, and we must adopt a system capable of easy modification as our knowledge increases. Another point which Chevalier Descamps made was that we adopt different methods with regard to different sciences; in some cases the numbers are followed by symbols; in some cases the numbers are separated by a hyphen, and so on. We have gone into this question as scientific men, and although perfectly ready to submit the result of our work to the criticism of other scientific men, we do believe that the plan that suits best one science will not suit another. Take one example. Take, for instance, zoology. There is the question of arrangement of the subject in accordance with the species of animals, and the question of arrangement with regard to the geographical distribution. Here are two ideas to which there is nothing similar in physics or chemistry. It would be disastrous if we attempt to force all these sciences to adopt the same method. If two things are essentially different, we do not apply the same principles to both. In the last place, Chevalier Descamps says the main object of classification is to tell us where to find a particular object with which we are dealing. I do not much believe in the average memory of scientific men being able to grasp a large number of numbers. I believe it is much easier to find the place by using symbols, which are more distinct than a large number is from a small one. Significant words which are for temporary use have their own meaning. You find them alphabetically.

Finally it was agreed that the authoritative decisions as to the schedules be intrusted to an international committee, to be hereafter named by the conference, together with three representatives of the Royal Society.

The final sitting of the conference was devoted to a consideration of the finances of the catalogue. Prof. Rücker's estimate was that the book catalogue would cost £5,600. The primary slip catalogue would require £3,000 a year, the secondary slip catalogue £6,000. Altogether, the undertaking would bring about in the five years an outlay of £40,000.

The United States has been asked to furnish $10,000, and numerous petitions have been forwarded to Washington to the various representatives of the government favoring such a grant, but so far without success. Prof. Adler in conclusion writes:

In view of the failure of Congress to make an appropriation for carrying on the work in this country, it will be necessary should the catalogue begin January 1, 1900, to make some special provision. It is hoped that by the co-operation of universities and libraries in five or six of the large centers the work can be carried on for one year, and that when the subject is next presented to Congress, it will meet with more favorable consideration.

It is most desirable that just such a catalogue, a universal scientific one, should be provided for. It will be of the greatest help for human advancement, and the advantages to us of the most practical kind. It would be selfish on our part if we did not bear a fair proportion of the cost.

The official mineral statistics of Bosnia and Herzegovina show that last year the production comprised, in metric tons: Fahlore, 583; copper ore, 3,785; iron ore, 58,532; chrome ore, 458; manganese ore, 5,319; zinc ore, 10; iron pyrites, 240; brown coal, 271,183; salt, 14,496 tons. The metallurgical production included also in metric tons: Quicksilver, 4; copper, 148; pig iron, 15,336; castings, 941; open hearth ingots, 8,669; malleable iron, 8,510 tons. The total number of miners employed was 3,910, and there were four fatal accidents during the year.—Engineering and Mining Journal.

THE GLACIERS IN MONTANA.

FOR some years I have been interested in the geography of a small section of the Rocky Mountains which until recently was part of the Blackfeet Reservation in Northwestern Montana. This section lies for the most part east of the Continental Divide and between the international boundary on the north and the Great Northern Railroad on the south. The portion of it which I know best is included in the watershed of the St. Mary's River and its tributaries. In 1891 I took to the head of the St. Mary's River the first party that had ever visited it so far as known, and in 1895 accompanied to the same point the government commission which afterward purchased from the Blackfeet Indians the rough mountain land which formed the western portion of the reservation of that tribe. Before that I had made a sketch map of the region, which is the basis of all the maps of it that have been made or published.

In 1897 I made a hasty trip to the head of the river and climbed Mount Jackson, the highest peak in that region. Last July (1898) I again went to the head of the river and climbed the Blackfoot Mountain, another lofty peak somewhat less accessible than Mount Jackson. On both trips I was accompanied by my friend, J. B. Monroe.

These last trips have enabled me definitely to locate two points about whose relations I have never until now been quite certain. One is the Pumpelly glacier, discovered by Prof. Raphael Pumpelly, who, I believe, in 1883, with a small party which included the late W. A. Stiles, crossed from the Flathead country to the plains by way of the Marias, or, as it is now called, the Cut Bank Pass. This great mass of ice, which is seen by every traveler going through the Cut Bank Pass, rises to the height of several hundred feet above the face of a lofty cliff, over which portions of the glacier are constantly falling with tremendous reports, which are heard for a long distance.

From the top of the Blackfoot Mountain, the whole country leading up to the Cut Bank Pass can be seen, and immediately below it to the southeast lies the Pumpelly glacier, readily identified not only from its position with relation to the valley, but also by the peaks and rocks in its neighborhood. It thus appears that the Pumpelly glacier, as I have long supposed was the case, is part of the southern flow of the great icecap which covers almost the whole of the Blackfoot Mountain. The Blackfoot glacier, which stretches away in a northeasterly direction from the peak of the Blackfoot Mountain, though perhaps varying in extent somewhat with the season, was estimated last July to be six or seven miles long, and in some places between three and four miles wide. From the peak of the Blackfoot Mountain the icefield flows also in a northerly direction, meeting another which runs down between Mount Kainah and Mount Jackson, while from Mount Jackson a number of smaller glaciers flow down to timber line.

A little to the west of south of the Blackfoot Mountain and lying in a great bend of Mud Creek—tributary of the Flathead—which entirely cuts it off from the main range, lies Mount James, one of the three highest peaks in this immediate section. Seen from the east, it is shaped like the square-faced, peaked end of a hay stack, and at a distance appears very difficult or impossible of ascent. Its southern and western faces may be more practicable than those on the north and east appear. From the top of the Blackfoot Mountain the level shows Mount Jackson to be the highest of all these mountains; Mount James the next, while Blackfoot is the third. But the differences in height are very slight.

A few miles northwest of Mount Jackson and lying on the west side of the range is a little basin named Avalanche Basin by L. B. Sperry, of Oberlin, Ohio, and on the mountains overlooking this, Mr. Sperry tells us, are extensive snowfields and a glacier. From the summit of Blackfoot Mountain it appears that this Avalanche Basin lies nearly south of Mount Piegan of my map, and southwest of Mount Reynolds. I understand that Mr. Sperry, who was, of course, unaware that the mountain had been earlier named, has called Mount Reynolds Matterhorn, from the slender—as seen from the southwest—finger of rock which forms its peak. Mount Reynolds is in the Continental Divide, although most of the recent maps wrongly place it east of the Divide.

If the locations of the Pumpelly glacier and of Avalanche Basin with regard to definite and well-known points in the Continental Divide are thus established, the matter is one of some interest to students of this section of the northern Rocky Mountains, since hitherto, as far as I am aware, the relations of the east and west sides of the range have not been known between the head of Belly River and the Cut Bank Pass.

Lying nearly to the south of Mount Jackson, and between it and the Blackfoot Mountain, is a deep basin which is the head of Harrison Creek, flowing down toward the Flathead Lake. This basin, which I have called Pinchot's Basin, is occupied by a large glacier, which is fed by many smaller ones flowing down the steep side of Mounts Jackson, Kainah, and Blackfoot. What the extent of this glacier may be I do not know, but lying in this deep basin, and almost completely surrounded by high mountains, the area of the moving ice must be very considerable.—George Bird Grinnell, in Science.

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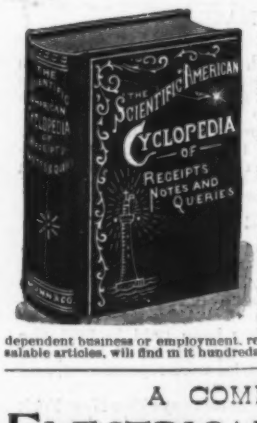

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TABLE OF CONTENTS.

PAGE

I. ANTHROPOLOGY.—The East India Village in the Vienna Zoological Garden.—3 illustrations. 19840

II. ARCHÆOLOGY.—Archæological Discoveries at Carthage.—II.—2 illustrations. 19847
Egyptian Papyri. 19847

III. CERAMICS.—Outline History of Brick Making. 19848

IV. CHEMISTRY.—Artificial Mineral Waters.—By THOMAS WARWICK. 19840
The Many Products of Coal Tar. 19842
The Nature of Valence.—By F. P. VENABLE. 19841

V. COMMERCE.—Trade Suggestions from United States Consuls. 19844
Trade with Our Possessions and Cuba. 19846

VI. GEOLOGY.—The Glaciers in Montana. 19854

VII. ILLUMINANTS.—Portable Acetylene Apparatus.—3 illustrations. 19849

VIII. ELECTRICITY.—An Improved Liquid Interrupter for Induction Coils.—1 illustration. 19849
Storage Battery Patents. 19849

IX. FIREARMS.—Automatic Pistols.—3 illustrations. 19841

X. LIQUORS.—The Preparation of Vermouth in France. 19853

XI. MARINE ENGINEERING.—First Large Cruisers of the British Navy.—4 illustrations. 19850
Russia's Great Naval Enterprise. 19852

XII. MECHANICAL ENGINEERING.—Portable Rail Saw.—1 illustration. 19843
The Lehmann Rotary Pump.—4 illustrations. 19843

XIII. MISCELLANEOUS.—An Open Maze.—1 illustration. 19853
Pulque—Mexico's National Drink.—3 illustrations. 19846
United States Mail on Street Cars. 19849
Selected Formulæ. 19845
Miscellaneous Notes. 19845
Trade Receipts and Suggestions. 19845

XIV. NATURAL HISTORY.—Spiders' Musical Organs. 19840

XV. SCIENCE.—The Catalogue of Science. 19853

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